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SMW Project 5149

MAYOR'S OFFICE OF EMERGENCY MANAGEMENT

New York, NY

Audiovisual Specification

Prepared for:

Swanke, Hayden and Connell Architects
New York, New York

April 06, 1998

Section I

SCOPE OF WORK

This specification defines certain audiovisual and television systems to be furnished and installed in the Mayor's Office of Emergency Management being constructed at 7 World Trade Center, located in New York City, New York.

(End of Section I)

Section II

INSTRUCTIONS TO BIDDERS

A. QUALIFICATIONS OF BIDDERS

The Bidder shall be a firm with at least five years experience in the fabrication, assembly, and installation of television and audiovisual systems of similar magnitude and quality as specified for the subject job, and shall submit documentation to this effect with the bid return.

B. DEFINITION OF TERMS

The term "Owner" shall refer to **The City of New York.**

The term "Architect" shall refer to **Swanke Hayden and Connell Architects.**

The term "Consultant" shall refer to **Shen Milsom & Wilke, Inc.**

The term "Bidder" shall refer to a firm submitting a bid response to this specification.

The term "Contractor" shall refer to the Systems Contractor who has been awarded the contract for the subject job and who has responsibility for performance of the work specified herein.

The term "NIC" shall refer to material and work which is Not In Contract and for which the Contractor is not responsible except as otherwise detailed herein.

The term "OFE" shall refer to "Owner Furnished Equipment", which will be provided by the Owner to the Contractor. The Contractor shall be responsible for installing and integrating this equipment as detailed herein.

The term "shall" is mandatory; the term "will" is informative; the term "should" is advisory; and the term "provide" means furnish and install.

C. INFORMATION TO BE SUBMITTED WITH BID RETURN

1. Equipment Costs

The bid return shall include detailed lists of all equipment to be supplied. Each piece of equipment shall be individually priced. Equipment lists are provided herein under the Detailed Specifications. Copies of these lists may be used, with the appropriate price information added. Equipment costs shall reflect all required modifications and accessories.

Equipment totals from each equipment list shall be entered in the Master Recapitulation of Costs form in Section VII.

2. Non-Equipment Costs

Non-equipment costs shall be furnished separately on the Master Recapitulation of Costs form in Section VI. These non-equipment costs shall be detailed for each of the following categories:

a) Engineering: Including all required design, drawings, run sheets, instruction manuals, etc.

b) Pre-Installation: Including all fabrication, modification, assembly, rack wiring, etc., performed on the Contractor's premises.

c) Installation: Including all on-site installation and wiring, coordination and supervision, testing, checkout, Owner training, etc. performed on the Owner's premises.

d) General and Administrative: Including all G & A expenses, shipping, insurance, and guarantees.

3. Warranty Statement

To maintain certain manufacturers' warranties, said equipment must be installed, aligned and serviced by those installers authorized by said manufacturer to perform those duties. If the contractor is not authorized by said manufacturer, it is his sole responsibility to make the appropriate arrangements and bear all cost and consequences thereof.

The Bidder shall include a statement of warranty on the entire system and on the individual pieces of equipment. The system warranty shall be for a minimum of 365 days from the date of system acceptance by the Consultant. This warranty shall obligate the Contractor to provide all equipment, material, and on-site labor at no charge to the Owner, during the warranty period, in the event of system or equipment malfunction. The warranty statement shall also provide for four (4)

preventative maintenance visits.

All manufacturer's equipment warranties shall be activated in the Owner's name and shall commence on the date of system acceptance. In the case of Contractor-modified equipment, the manufacturer's warranty is normally voided. In such cases, the Contractor shall provide the Owner with a warranty equivalent to that of the original manufacturer.

4. Service Contract

The Bidder shall offer a separate annual service contract, covering all installed systems. This service contract shall cover a minimum of four (4) visits per year, at regular intervals, to perform operation checks of the equipment, to clean recording heads, screens, projector lenses and other critical surfaces, to lubricate moving parts as recommended by the respective manufacturers and to adjust and align projectors to maintain optimum registration and focus. The service contract shall commence immediately after expiration of the warranty period.

The Bidder shall also submit separate costs for other emergency situation "on-call" service visits and an "in-shop" hourly rate for repair and maintenance work.

The costs for this service contract shall not be commingled with the costs for the systems base bid.

5. Schedule of Implementation

The Bidder shall submit a scheduling plan with the bid return, indicating the various pertinent terminal dates after award of contract for completion of design, pre-installation work, on-site installation work, and testing and acceptance.

Construction on this project is scheduled to be completed by October 1, 1998.

6. Alternate Equipment

All bids shall be submitted on the basis of the specified equipment. The bidder may propose alternate equipment. However, all such proposals shall be submitted separately and will be identified as "alternates" with equipment costs shown separate and apart from the costs of the equipment "as specified". Proposals for alternate equipment will receive careful and equitable consideration if the differences do not depart from the overall intent of the design and operation of the system, and are in the best interests of the Owner.

All such proposals for alternate equipment shall be accompanied by full technical information, "cuts" and specifications for the equipment so proposed. The Bidder

shall identify the substantive differences between the alternate and the specified equipment.

7. Exceptions

Any and all exceptions to these specifications and related drawings must be made with the bid submission. In the absence of exceptions, these specifications and related drawings shall be binding in letter and intent on the successful Bidder. It will further be assumed that the Bidder has examined the design and specifications in detail, and is prepared to take full responsibility for the performance of the complete installation as designed and specified.

8. Sub-Contract Information

If the Bidder proposes to sub-contract portions of the work, as provided for under Section II-F which follows, such sub-contractors shall be identified and their responsibilities and qualifications detailed in the Bidder's bid submission. The work as performed by a sub-contractor shall be considered as part of the contractor's responsibility with that work as part of the contractor's statement.

For any work which must be sub-contracted, all sub-contractors must be identified in writing at the time of the bid response. Additionally, any equipment item for which a bidder is not an authorized dealer/service agent must be identified. The purchasing source as well as method of handling installation, service and warranty must be stated.

The bidder is responsible for coordinating all subcontractor's information submittal packages. Any submittals sent directly from subcontractors, on subcontractors' letterhead, or with title block will be rejected.

D. SPECIFICATION DRAWINGS

All drawings referred to herein are furnished with and become an integral part of this specification. These drawings and specifications shall remain the property of the Owner and shall be returned by all unsuccessful bidders, within 10 days after formal notification.

E. SPECIFICATION INFORMATION REQUESTS

Any requests for clarification, substitution, or changes in these specifications or drawings shall be directed to **Mr. Peter Stern** of Shen Milsom & Wilke, Inc., 417 Fifth Avenue, New York, N.Y. 10016, Tel: 212/725-2552, in writing. These information requests will be entertained no later than one calendar week before the bid closing date.

F. SUB-CONTRACT

If the Bidder proposes to sub-contract the installation and wiring, or other portions of the work, the Bidder shall provide direct supervision of the sub-contracted work.

Because of the complexity of the systems, the supervision of such sub-contracted work cannot be intermittent, but shall be continuous during the installation.

G. INVESTIGATION OF CONTRACTUAL AND SCHEDULING QUESTIONS

It shall be the responsibility of the Bidder to investigate all potential contract, union, and scheduling questions, and to guarantee compliance with all requirements and regulations in effect on the job site. Any potential problems in this respect shall be identified in the bid return.

H. AWARD OF CONTRACT

A single award of contract will be made for all systems as detailed in this specification.

The Owner reserves the right to reject any or all bids for any reason.

(End of Section II)

Section III

GENERAL SPECIFICATION

A. CONTRACTOR'S GENERAL RESPONSIBILITIES

The Contractor shall be responsible for delivering a turnkey system to the Owner.

The Contractor shall furnish all equipment and materials, whether specifically mentioned herein or not, to ensure a complete and operating system. The NIC and OFE equipment and materials are specifically exempted from this requirement.

The Contractor shall generate all shop drawings and information for the complete installation and wiring of the system. The Contractor shall provide (or sub-contract for) the on-site installation and wiring, and shall provide on-going supervision and coordination during the implementation phase.

The Contractor shall be responsible for the initial adjustment of the systems as herein prescribed and shall provide all test equipment for the system checkout and acceptance tests. Contractor shall provide on-the-job training in the operation and maintenance of the systems for personnel designated by the Owner.

B. NOT IN CONTRACT (NIC)

Certain equipment and materials will be provided and installed by others. Unless otherwise indicated in these specifications, or on the related drawings, these will include the following:

1. All conduits, wireways, connection boxes, pull boxes, junction boxes, and outlet boxes permanently installed in walls, floors, and ceilings.

2. All room lighting fixtures, dimmers, power receptacle outlets, and interconnecting wiring for these circuits.

3. All electrical breaker panels required to power the audiovisual and television equipment.

4. All structural work, wall openings, platforms, railings, stairs, fire prevention and safety devices, rough and finished trim, painting and patching, drapes, carpets, floor coverings, computer floors, glazing, acoustical treatments, and heating, ventilating, and air conditioning systems.

5. Moveable furniture, desks, and chairs.

6. Ceiling speaker back boxes.

C. QUALITY OF MATERIALS AND EQUIPMENT

All materials and equipment supplied by the Contractor shall be new and shall meet or exceed the latest published specification of the manufacturer in all respects.

The Contractor shall supply the latest model, available at the time of bidding, of each piece of equipment.

D. CONTRACTOR'S DOCUMENTATION

1. Prior to fabrication the Contractor shall submit to the Consultant, for approval, any custom designs pertaining to the systems. Drawing submittals shall be on reproducible media. These designs include, but are not limited to, the following:

   a) Complete system construction and point to point wiring schematic drawings, including all component values and showing complete letter and number identification of all wire and cable as well as jacks, terminals and connectors.

   b) All panels, plates, and designation strips, including details relating to terminology, engraving, finish and color.

   c) All custom designed consoles, tables, carts, support bases, and shelves.

   d) Schematic drawings of all custom components, assemblies and circuitry.

   e) All unusual equipment modifications.

   f) Run sheets or field wiring details.

   g) Patch panel assignment layout drawings.

   h) Front mechanical drawings of each equipment rack.

   i) All items of equipment whether a stock manufactured item or custom built shall be supported by complete and detailed schematic drawings and replacement parts lists. No "black boxes" or unidentified components shall be acceptable under this specification.

j) Verification of the focal lengths of projection lenses to achieve the specified image sizes.

2. At the completion of the installation, the Contractor shall provide three (3) copies each of the following:

a) Equipment manufacturer's operation and maintenance manuals for each piece of equipment.

b) "As-built" drawings for every item indicated in Section III-D-1.

c) System functional block drawing identical to the SM&W specification drawing with the addition of all input and output circuit cable and terminal block numbers as well as all jack field circuit I.D. designations. A copy of this drawing shall be framed in protective plastic and mounted on the inner surface of the equipment rack door.

d) A System Operation and Maintenance Manual. This manual shall be produced by the Contractor specifically for the systems detailed herein.

The "Operation" section shall describe all typical procedures necessary to activate each system to provide for the functional requirements as listed under the Detailed Specifications.

The reader of this manual shall be assumed to be technically competent, but unfamiliar with this particular facility. It is estimated that this manual will require a minimum of 30 pages.

The "Maintenance" section shall provide a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where inadequate information is provided by the manufacturer, the Contractor shall provide the information necessary for proper maintenance.

Two copies of the above documentation will be retained by the Owner. One copy shall be delivered to the Consultant prior to the System Acceptance Tests.

E. SUB-CONTRACT

No sub-contract will be permitted for the Contractor's responsibilities, as herein defined, unless specifically identified in the bid submission and approved by the Owner.

The Contractor shall have sole responsibility for the satisfactory implementation of each system, even though the Contractor may have sub-contracted a portion of the installation

or had certain manufacturers install their own equipment.

F. COOPERATION WITH OTHER TRADES

It shall be the responsibility of the Contractor to cooperate at all times, and to the fullest extent, with all trades doing work in the building, to the end that lost time, work stoppages, interference, and inefficiencies do not occur.

G. EQUIPMENT DELIVERY AND STORAGE

Costs of all shipping to the site, and of all unusual storage requirements, shall be borne by the Contractor. It shall be the responsibility of the Contractor to make appropriate arrangements, and to coordinate with authorized personnel at the site, for the proper acceptance, handling, protection, and storage of equipment so delivered.

H. CLEANUP AND REPAIR

Upon completion of the work the Contractor shall remove all his refuse and rubbish from and about the premises, and shall leave the relevant areas and equipment clean and in an operational state. The Contractor shall be responsible for repairing any damage caused to the premises by the Contractor's installation activities, at no cost to the Owner.

I. OWNER TRAINING

The Contractor shall provide on-the-job training by a suitably qualified instructor, to personnel designated by the Owner, to instruct them in the operation and maintenance of the systems. In the event the Contractor does not have qualified instructors on staff for certain sophisticated equipment, a manufacturer's representative for such instruction will be provided by the contractor at no additional cost to the owner. All training shall take place after the systems are operational, but before the acceptance tests. There shall be a minimum of 1 day of training on the systems included in this specification. The training will not be considered complete until the Owner is able to completely operate the system.

J. PUBLICATION

No information relative to this job may be released for publication without prior written approval from the Owner, the Architect, and the Consultant.

K. INSURANCE

Before commencing work, the Contractor shall procure and maintain, during the life of the contract, such comprehensive liability and property damage insurance as shall protect him and the Owner from claims for bodily injury, including death, and claims for

property damage which may arise from the operations under this contract.

L. INSTALLATION PRACTICES

1. General

Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.

All installation practices shall be in accordance with, but not limited to, these specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements, and recommendations of National, State, and Local authorities having jurisdiction.

If, in the opinion of the Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification shall be made to the Consultant. Modifications shall not commence without written approval from the Consultant.

During the installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, he shall replace or repair such work at no cost to the Owner.

2. Physical Installation

All equipment shall be firmly secured in place unless requirements of portability dictate otherwise.

Fastenings and supports shall be adequate to support their loads with a safety factor of at least three.

All boxes, equipment, etc., shall be secured plumb and square.

In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

3. Cable Installation

All cables, regardless of length, shall be marked with wrap-around number or letter cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and or run sheets.

All inter-rack cabling shall be neatly strapped, dressed, and adequately supported.

Terminal blocks, boards, strips, or connectors, shall be furnished for all cables which interface with racks, cabinets, consoles, or equipment modules. No audio cables shall run directly to the audio patch panel jacks. Each audio patch panel shall be furnished with an audio terminal block, and all audio cables to and from the audio patch panel shall terminate on this block.

All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:

a) Power cables
b) Control cables
c) Video cables
d) Audio cables carrying signals less than -20 dBm.
e) Audio cables carrying signals between -20 dBm and +20 dBm.
f) Audio cables carrying signals above +20 dBm.

As a general practice, all power cables, control cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.

Unless otherwise called for in these specifications and drawings, the following cables, their approved equals **or the plenum rated equivalents**, shall be used in these systems:

RF (MATV) .....Belden 9290
Video (Baseband).....Belden 8281
Control (4 conductor shielded) .....Belden 9418
Control (12 conductor shielded) .....Belden 9556
Audio.....Belden 8451
Audio (8 ohm program speakers).....Belden 8473

All cables (except video and pulse cables which must be cut to an electrical length) shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the Consultant. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

4. Connection Plate Receptacles

Unless otherwise detailed herein, the following types of panel receptacles shall be used on all connection boxes, panels, plates, and wireways:

a) Audio (microphone or line level) - XLR type.
b) Audio (loudspeaker level) - 3 inch diameter tip/ring/sleeve type. Jack shall be insulated from panel type.
c) Intercom - 3 inch diameter tip/ring/sleeve type. Jack shall be insulated from panel type.
d) Video - BNC type. Receptacles shall be insulated from panel type.

5. Patch Panel Assignments

All patch panels shall be wired so that signal "sources" (outputs from) appear on the upper row of a row pair; and all "loads" (inputs to) appear on the lower row of a row pair.

6. Patch Panel Designation Strips

All audio and video patch panel designation strips shall utilize alphanumeric identifications and descriptive information. The jack position in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings, as well as on reproductions of these drawings which shall be mounted in an appropriate location near the patch bays.

7. Grounding Procedures

In order to minimize problems resulting from improper grounding, and to achieve maximum signal-to-noise ratios, the following grounding procedures shall be adhered to:

a) System Grounds: A single primary "system ground" shall be established for the systems in each particular area. All grounding conductors in that area shall connect to this primary system ground. The system ground shall be provided in the audio equipment rack for the area, and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors.

A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the primary system ground bar to the nearest metallic electrical conduit of at least 2 inches in diameter. The Contractor shall be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system.

Secondary system grounding conductors shall be provided from all racks, audio consoles, and ungrounded audio equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.

Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.

b) Audio Cable Shields: All audio cable shields shall be grounded at one point only. There are no exceptions. For inter and intra-rack wiring this requires that the shield be connected at one end only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.

c) Video Receptacles: All video receptacles that are provided and installed by the Contractor shall be insulated from the mounting panel, outlet box, or wireway. Unless otherwise detailed herein, this shall be accomplished by using insulated-from-panel type receptacles.

d) General: Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems.

M. PERFORMANCE STANDARDS

Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required under the Detailed Specifications, the following performance standards shall be met by each system:

1. Audio:

S/N (including crosstalk and hum)	...	55 dB minimum.
Total Harmonic Distortion	...	1% maximum from 30 Hz to 15,000 Hz.
Frequency Response	...	Within plus or minus 1.0 dB, 30 Hz to 15,000 Hz.

2. Video (signal):

S/N (peak to RMS) unweighted DC to 4.2 mHz.	...	55 dB minimum.

Crosstalk, unweighted DC to 4.2 mHz.	...	45 dB minimum.
Frequency Response	...	Within plus or minus 0.5 dB to 4.2 mHz.
Line and Field Tilt	...	2% maximum.
Differential Gain	...	3% maximum.
Differential Gain	...	2 degrees maximum.

3. Performance Test Signal Paths

The signal paths for the above Performance Standards shall be as follows:

a) Audio:

From all source inputs (for microphones, audio tape units, video tape units, etc.) through all mixers, ADAs, switchers, etc., to all signal destinations.

b) Video Signal:

From all source inputs (for cameras, video tape units, etc.) through all processors, switchers, etc., to all signal destinations.

The delineation of the above signal paths shall not exempt the Contractor from the responsibility of checking all paths and outlets for appropriate compliance with the Performance Standards.

4. Optical:

All optical projection systems shall meet the following performance standards:

a) The total averaged light output from a projector, in lumens, shall be within plus-or-minus 15% of that specified by the projector manufacturer.

b) The light fall-off from the center of the projected image to all four corners, as measured at the projected image plane, shall not exceed 50% for 16mm film projector images nor 35% for slide projector images. The light intensity shall be measured at all five positions of the projected image after the projector has been adjusted to provide the light output as specified above.

The "corner" locations shall be defined as the four points determined by intersecting lines drawn 5% of the distance in from the focused edges of the image.

c) The light meter used for the above measurements shall be a properly calibrated footcandle (or lux) meter and shall be cosine-corrected.

d) Projectors, lenses, and mirrors shall be solidly mounted and braced so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.

5. During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacturer.

N. CONTRACTOR SYSTEM CHECKOUT

Before Acceptance Tests are scheduled, the Contractor shall perform his own system checkout. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:

1. Test all audio and video systems for compliance with the Performance Standards, and submit test results and test procedures. Including test equipment make and model number.

2. Check all control functions, from all controlling devices to all controlled devices, for proper operation.

3. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual".

4. Check all optical projection images for average light level, light fall-off, and image alignment and size to comply with the Performance Standards and specification drawings. Check to determine that all projectors, projector bases, carts, tables, and mirrors are rigid and vibrationless in operation.

5. Maintain documentation of all performance tests for reference by the Consultant during the System Acceptance Tests.

O. SYSTEM ACCEPTANCE TESTS

System Acceptance Tests will not be performed until the Contractor's System Checkout has been completed. The System Acceptance Tests will be supervised by the Consultant and will consist of the following:

1. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.

2. The operation of all system equipment shall be demonstrated by the Contractor.

3. Both subjective and objective tests will be required by the Consultant to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.

4. All final, "as-built" drawings, run sheets, manuals, and other required documents, as detailed in Section III-D-3, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to the Consultant prior to the scheduling of Acceptance Tests).

5. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Consultant.

P. RECOGNITION

1. All installations shall bear the following identification plate, supplied by this contractor, mounted on the front of the main rack at the top:

SYSTEMS ENGINEERED & DESIGNED BY:

SHEN MILSOM & WILKE, INC.
417 FIFTH AVENUE
NEW YORK, N.Y. 10016
212/725-6800

SYSTEM FABRICATED & INSTALLED BY:

(This Contractor)

Engraving shall be white filled Helvetica lettering on a black background or as appropriate to the identification plate material.

(End of Section III)

Section IV

MASTER DRAWING LIST

DRAWING NUMBER	DRAWING TITLE
AV-1	Emergency Operation Center; AV Facilities Plan
AV-2	Mayor's/Commissioner's Suites; AV Facilities Plan
AV-3	Watch Command/Press Room; AV Facilities Plan
AV-4	PIU/Training Room; AV Facilities Plan
AV-E0	Audiovisual Electrical Symbols
AV-E1	Emergency Operations Center; AV Electrical Plans
AV-E2	Mayor's/Commissioner's Suites; AV Electrical Plans
AV-E3	Watch Command/Press Room; AV Electrical Plans
AV-E4	PIU/Training Room; AV Electrical Plans
AV-E5	AV Head End Signal Distribution; Coaxial Cable Backbone
AV-S1	RGB/Video Functional Diagram; Emergency Operations Center
AV-S2	RGB/Video Functional Diagram; Mayor's Conference Room
AV-S3	Master Audio System; Functional Diagram
AV-S4	RGB/Video/Audio Functional Diagram; PIU/Training Room
AV-S5	Audio Functional Diagram; Mayor's/Commissioner's Suites
AV-S6	Press Feed System Distribution; AV Functional Diagram
AV-S7	OEM Complex; RF Distribution/Head End System
AV-S8	Master Control System; Control System Functionality

(End of Section IV)

Section V

FUNCTIONAL REQUIREMENTS

AREA: EMERGENCY OPERATION CENTER

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in Operation Center.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide four (4) single centered rear projected image of video signals and computer data projection.

2. Provide all projection system mounting and mirror assemblies, including, but not limited to, front surface mirrors.

3. Provide thirty two (32) RGB monitors (37") to be installed in Owner Furnished millwork modules.

4. Provide eight (8) RGB monitors (29") to be ceiling mounted, with the appropriate installation hardware.

Audio

1. Provide computer controlled speech re-inforcement system through zoned ceiling speakers. This system will include microphones and table stands. Program audio in this area will also be reproduced through the ceiling speakers.

2. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide RGBS matrix switch for switching any source to any destination.

2. Provide for the display of computer generated signals via the video projection systems.

3. Provide for the display of CATV signals via the video projection systems.

4. Provide for the display of a document camera (or other external video source) via the video projection systems.

5. Provide video line doubler/switchers in order to convert composite video signals to RGBS signals for input to the display systems.

6. Provide matrix routing of video and audio signals to/from the Operation Center.

7. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audiovisual system control from one (1) wired touch panels. Panels are to be installed at the Supervisor's desks.

2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: MAYOR'S CONFERENCE ROOM

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in the Mayor's Conference Room.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide single centered rear projected image of video signals and computer data projection.

2. Provide all projection system mounting and mirror assemblies, including, but not limited to, front surface mirrors.

3. Provide six (6) RGB monitors (29") to be installed in millwork, flanking the rear screen.

Audio

1. Provide program audio system to support video systems.

2. Provide program audio loudspeakers.

3. Provide audio teleconferencing system, with record capability, and table microphones.

4. Provide audio cassette recorder.

5. Provide ceiling speakers for teleconference and program audio re-inforcement.

6. Provide wireless microphone/receiver.

7. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide playback of VHS video tapes.

2. Provide for the display of computer generated signals.

3. Provide for the display of CATV signals.

4. Provide for the display of the Video Teleconference system.

5. Provide video line doubler/switchers in order to convert composite video signals to RGBS signals for input to the display systems.

6. Provide matrix switching for local and EOC RGBS sources.

7. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audio/visual system control from wired LCD color touch panel.

2. Provide audio/visual system control from a hand-held wireless LCD control panel.

3. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: MAYOR'S SUITE

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in Mayor's Suite.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide two (2) flat panel (gas plasma) displays.

2. Provide all necessary wall mounting hardware.

Audio

1. Provide program audio system to support video systems.

2. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide playback of VHS video tapes.

2. Provide for the display of CATV signals.

3. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audiovisual system control from a wireless touch panel

2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: COMMISSIONER'S SUITE

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in Commissioner's Suite.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide four (4) RGBS monitors (29") to be installed in custom millwork.

2. Provide one (1) RGBS monitor (37") to be installed in custom millwork.

Audio

1. Provide audio system to support video systems.

2. Provide audio cassette recorder.

3. Provide compact disk player.

4. Provide line level mixer.

5. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide playback of VHS video tapes.

2. Provide for the display of computer generated signals.

3. Provide for the display of CATV signals.

4. Provide video line doubler/switchers in order to convert composite video signals to RGBS signals for input to the display systems.

5. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audiovisual system control from a wired color LCD touch panel

2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: WATCH COMMAND

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in the Watch Command.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide eight (8) RGB monitors (29") to be ceiling mounted, with the appropriate installation hardware.

Audio

1. Provide audio system to support video systems.
2. Provide ceiling speakers.
3. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. There are no local video or computer sources in this area. All sources are routed through the EOC matrix switch.
2. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audiovisual system control from a wired color LCD touch panel.
2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: PRESS ROOM

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in the Press Room.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide two (2) RGB monitors (37") to be ceiling mounted, with the appropriate installation hardware.

Audio

1. Provide audio system to support video systems.
2. Provide ceiling speakers.
3. Provide podium microphone, with shock mount.
4. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide VCR, to be installed in monitor mount.
2. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audiovisual system control from a wireless LCD touch panel.
2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: PUBLIC INFORMATION UNIT/TRAINING ROOM

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in the PIU/Training Room.

SYSTEM FUNCTIONAL REQUIREMENTS

Projection/Display

1. Provide single centered front projected image of video signals and computer data projection.
2. Provide all projection system mounting .
3. Provide two (2) RGB monitors (37") to be ceiling mounted, with the appropriate installation hardware.

Audio

1. Provide program audio system to support video systems.
2. Provide program audio loudspeakers, with wall mounting hardware.
3. Provide audio cassette recorder.
4. Provide ceiling speakers for speech and program audio re-inforcement.
5. Provide podium microphone, with shock mount.
6. Provide wireless microphone/receiver.
7. Provide computer controlled 8 X 8 audio matrix.
8. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. Provide playback of VHS video tapes.
2. Provide for the display of computer generated signals.
3. Provide for the display of CATV signals.

4. Provide video line doubler/switchers in order to convert composite video signals to RGBS signals for input to the display systems.

5. Provide matrix switching for local and EOC RGBS sources.

6. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Control

1. Provide audio/visual system control from wired LCD color touch panel.

2. Provide all low voltage relays, interface modules and power supplies, etc. required to operate the AV control system.

AREA: HEAD END/RF DISTRIBUTION SYSTEM

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in the LAN/Head End Room.

SYSTEM FUNCTIONAL REQUIREMENTS

Broadband

1. Provide turnkey head end system. All signal processors, modulators, filters and other RF components shall be from a single manufacturer.

2. Where applicable, all signal processing equipment shall be frequency agile.

3. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video/Display

1. Provide video matrix switch, for switching of locally provided sources to designated channel assignments.

2. Provide for playback of VHS tapes on assigned channel.

3. Provide seven (7) tuners and scan doublers for routing RF information through EOC matrix switch.

4. Provide seventy four (74) receivers (13") for installation in EOC consoles

AREA: PRESS DISTRIBUTION SYSTEM

GENERAL

This section of the specification defines the details of the audiovisual systems to be furnished and installed in for the Press Distribution system.

SYSTEM FUNCTIONAL REQUIREMENTS

Audio

1. Provide audio distribution amplifiers for line level audio feeds to the EOC Camera Riser, the Press Room Camera Riser, and the fiber plant.

2. Provide floor box plates and wall plates to allow intercom (NIC; supplied by Press Corps) connectivity to loop from the fiber plant through the Press Room Camera Riser to the EOC Camera Riser.

3. Provide connectivity at street level from fiber plant to copper based Press Connection Panels for all video and audio signals.

4. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Video

1. All video will be originated by video cameras (NIC) supplied by the Press Corps.

2. Provide floor box plates and wall plates to allow video to loop from EOC Camera Riser through the Press Room Camera Riser to the fiber plant.

3. Provide connectivity at street level from fiber plant to copper based Press Connection Panels for all video and audio signals.

4. Provide video monitors, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

Fiber Plant

1. Provide turnkey fiber system. All transmitters, receivers, modulators, multiplexers and other fiber components shall be from a single manufacturer.

2. All equipment shall provide studio quality video and audio.

3. Provide all signal combiners, signal dividers,equalizers, switchers, patch panels, distribution amplifiers and all other items as required to complete a full working system.

SYSTEM INTERCONNECTIONS

1. The functional interconnections of the audio control systems shall be as detailed on drawings.

2. The Contractor shall provide all interconnection cable, connectors, terminal strips, wireway, flexible conduit, etc., to facilitate the audiovisual systems as detailed within these specifications and drawings.

3. The conduit and power system are detailed in the Electrical Engineer's drawings.

SPECIAL INSTRUCTIONS

1. The system contractor shall inspect all owner furnished existing equipment and issue a written report as to its operational condition. They shall recommend the replacement of non functioning items for the approval of the City of New York and Shen Milsom & Wilke. The system contractor shall then include with their bid returns an alternate bid price for the replacement of the non-functioning items.

OWNER FURNISHED EQUIPMENT

1. All room furniture will be furnished by the Owner.

2. All computer and computer furniture will be furnished by the Owner.

RELATED WORK SPECIFIED ELSEWHERE

The following systems and equipment are <u>not</u> provided under this contract:

1. Lighting system and dimmers. Task and general lighting systems.

2. Writing surface.

3. Motorized front projection screens.

4. Rigid glass rear projection screens.

5. Ceiling speaker backboxes.

6. Power and conduits systems.

7. Audiovisual floorboxes.

8. Telecommunication services (voice/data/dedicated VTC lines).

9. Millwork and furniture systems.

10. Lecterns.

SECTION VI

EQUIPMENT LIST

AREA: EMERGENCY OPERATIONS CENTER

ITEM	QTY	DESCRIPTION	COST
		PROJECTION/DISPLAY SYSTEMS	
1.	4	Video/Data Projector, reflective LCD, high light output, multi-frequency input, native 1024 X 768 resolution, RS232 control, with lens, complete with spare lamps.	_____
		SHARP XG-3000	
2.	4	Projector and mirror support assemblies, front surface coated glass, complete with support frames as required.	_____
		CUSTOM BY AV CONTRACTOR	
3.	32	Video/Data Monitor, 37", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control.	_____
		NEC MULTISYNC XP37 PLUS (XP3790)	
4.	8	Video/Data Monitor, 29", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control.	_____
		NEC MULTISYNC XP29 PLUS (XP2990)	
		VIDEO SYSTEM	
5.	1	Matrix switcher, RGBS 32 X 80 (150 Mhz), local control panel, RS232, rackmounted.	_____
		PESA QUOTE #9804026BH (32X80)	
6.	7	Universal Analog RGBS computer interface, with digial controls, complete with the monitor breakout cables and RGBS extension cables as required.	_____
		EXTRON RGB 300 **EXTRON RGBS EXTENSION CABLES** **EXTRON MBC-SVGA 26-162-01**	

AREA: EMERGENCY OPERATIONS CENTER

ITEM	QTY.	DESCRIPTION	COST
7.	4	Video patch bay, minimum 2 X 24 jacks, with high bandwidth normal through self -terminating jacks, for computer video. Include color-coded patch cords. **CANARE 242U-VJ22W-C**	_____
8.	1	Videocassette player/recorder, ½" S-VHS, rackmounted **SONY SVO-1620** **MIDDLE ATLANTIC RACK MOUNT**	_____
9.	1	Scan doubler, with minimum three (3) video/s-video inputs, with audio follow video, multiple format output, RS-232 control, rack mountable. **EXTRON SYSTEM 4LDcx**	_____
10.	1	RGBS high resolution monitor, 17" diagonal picture, 1280 X 1024 minimum resolution, with rack mounts. ***MITSUBISHI DIAMOND PRO 700 OR*** **APPROVED EQUAL**	_____
11.	74	Console monitor, NTSC, with built in tuner, 13" diagonal. **SONY KV-13M30**	_____

AUDIO SYSTEMS

12.	Lot	Computer controlled audio system, including all hardware, software, 32KHz breakout boxes, DSP cards as necessary, keyboard, mouse, monitor, rack mount accessories, etc. **PEAVEY MEDIA MATRIX MM740** **PEAVEY MM8830 DIGITAL INTERFACE** **PEAVEY PASHA OPTION**	_____
13.	12	Dynamic microphones, with cardioid pick-up pattern, with desk stands. **SHURE SM-58LC OR APPROVED EQUAL**	_____

AREA: EMERGENCY OPERATIONS CENTER

ITEM	QTY	DESCRIPTION	COST
14.	2	Eight (8) channel microphone pre-amplifier, with 48V phantom power, gain controls and LED indicators.	
		PEAVEY A/A-8P	
15.	6	Single channel power amplifier, 60 watts into an 8 ohm load, 70 volt, include input modules and rack mountsas necessary.	
		TOA P906MKII	
16.	30	Four (4") ceiling speakers, with integral transformer.	
		ATLAS/SONDELIER FC104/T47	

CONTROL

17.	Lot	Active matrix color touch screen control panel, portable, located at Supervisor's desks in the podium. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics.	
		AMX CONTROL SYSTEM QUOTE # MAS98D01ER **CRESTRON CONTROL SYSTEM QUOTE #1054**	

MISCELLANEOUS

18.	1	Control system shall be connected to Unswitched power and shall be provided with a power line conditioner.	
		AMERICAN POWER CONVERSION (APC) LINE-R 1250	
19.	1	Rack auxiliary input/output panel	
		CUSTOM BY AV CONTRACTOR	

AREA: EMERGENCY OPERATIONS CENTER

ITEM	QTY	DESCRIPTION	COST
20.	3	Equipment rack, black, with vents, blank panels, locking back door, rack shelves, fans and power strips required to complete installation. **MIDDLE ATLANTIC MRK 44-26** **ALL ACCESSORIES AS REQUIRED**	_____
21.	LOT	Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system. ***CUSTOM BY AV CONTRACTOR***	_____

The following equipment shall be furnished by the A/V Contractor, and installed by others:

22.	LOT	1 X 4 projection screen wall, utilizing ¼" acrylic screens and P2000 framing system; all screens to provide a 54" high by 72" wide image. **STEWART FILMSCREEN AEROVIEW 100** **PERIMETER 2000 FRAMING SYSTEM**	_____
23.	30	Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. **ATLAS/SOUNDOLIER E-410 ENCLOSURE** **ATLAS/SOUNDOLIER 51-4 GRILLE**	_____
24.	5	Floor boxes, for raised access, carpeted, computer flooring with. Lift off full access door and fold back cable exit. **FSR FL-540P RAISED ACCESS FLOOR BOX**	_____
25.	8	Ceiling mount brackets for 29" ceiling mounted monitors. **PIVOTELLI OR APPROVED EQUAL**	_____
26.	1	Ceiling mounted screen, with tab-tensioned system; viewing area 60" high X 80" wide, with low-voltage interface. **STEWART FILMSCREEN MODEL A**	_____

AREA: MAYOR'S CONFERENCE ROOM

ITEM	QTY	DESCRIPTION	COST
PROJECTION/DISPLAY SYSTEMS			
1.	1	Video/Data Projector, reflective LCD, high light output, multi-frequency input, native 1024 X 768 resolution, RS232 control, with lens, complete with spare lamps.	_____
		SHARP XG-3000	
2.	1	Projector and mirror support assemblies, front surface coated glass, complete with support frames as required.	_____
		CUSTOM BY AV CONTRACTOR	
3	6	Video/Data Monitor, 29", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control.	_____
		NEC MULTISYNC XP29 PLUS (XP2990)	
VIDEO SYSTEM			
4	1	Matrix switcher, 16 X 16 (200 Mhz) with 16 x16 stereo audio, complete with break-away switching, local control panel, RS232 control, rackmounted.	_____
		EXTRON CROSSPOINT 1616HVA	
5.	2	Universal Analog RGBS computer interface, with digial controls, complete with the monitor breakout cables and RGBS extension cables as required.	_____
		EXTRON RGB 300 **EXTRON RGBS EXTENSION CABLES** **EXTRON MBC-SVGA 26-162-01**	
6.	1	Videocassette player/recorder, ½" S-VHS, rackmounted	_____
		SONY SVO-1620 **MIDDLE ATLANTIC RACK MOUNT**	

AREA: MAYOR'S CONFERENCE ROOM

ITEM	QTY	DESCRIPTION	COST
7.	2	Scan doubler, with minimum three (3) video/s-video inputs, with audio follow video, multiple format output, RS-232 control, rack mountable. **EXTRON SYSTEM 4LDcx**	_____
8.	1	S-Video switch, 6 input with 2 output, RS-232 control, internal power supply, with rack mount kit. **EXTRON SW 6 SV MX** **EXTRON 60-190-01 OR APPROVED EQUAL**	_____
9.	LOT	Signal distribution, two (2) video and one (1) distribution amplifers, with poser supplies and rack mounts. **SIGMA SERIES 26**	_____
10.	1	Videoconference system to include CODEC w/V.35 interface, far-end mulitpoint director control, 30 FPS, with slides. **PICTURETEL V4DZ2NV3501200E30** **PICTURETEL COUNTRY KIT S2-CK-A**	_____
12.	1	Inverse multiplexer, 4BRI, w/NT1 & CODEC cables. Include analog modem (56kbs) for remote diagnostics. **ASCEND MBV-BRI4U** **ASCEND PTEL V.35/RS-366 CABLE KIT**	_____
13	3	Video teleconferencing camera, video and s-video output, RS-232 control, with minimum four (4) presets. ***CANON VC-C3***	_____
14.	1	Video scan converter, minimum resolution input of 1280 by 1024, maximum horizontal scan rate of 85Khz (minimum), 24 bit color, broadcast quality, rack mountable. **RGB SPECTRUM VIDEOLINK 1650**	_____

AREA: MAYOR'S CONFERENCE ROOM

ITEM	QTY	DESCRIPTION	COST

AUDIO SYSTEMS

15. 1PR Program audio speakers, with internal crossover, mirror image matched left & right; magnetically shielded enclosures; with common subwoofer. _____

EASTERN ACOUSTIC WORKS JF-50S
EASTERN ACOUSTIC WORKS SB48

16. 2 Dual channel amplifier, 2 X 110 watts into an 8 ohms load, rackmountable. _____

CROWN CT-210

17. 1 Single channel power amplifier, 60 watts into an 8 ohm load, 70 volt, include muteable input modules and rack mounts as necessary. _____

TOA A906MKII

18. 1 Audio teleconferencing hybrid, with adaptive echo cancellation, 2-wire and 4-wire transmission, full duplex operation, RS-232 control, rack mountable. _____

SOUND CONTROL TECHNOLOGIES AVT-24

19. 1 Audio cassette player/recorder with rackmount _____

TASCAM 112

20. 2 Conference table boundary microphone, "tri-mic" configuration, with micro cardioid pick up pattern; black. _____

GENTNER DELTA

21. 1 Wireless diversity lavalier microphone system, cardioid pick up pattern, with rack mounted receiver. _____

LECTROSONICS DLS W/M150

22. 1 Eight (8) channel microphone mixer, switchable mic/line inputs, rack mountable. _____

LECTROSONICS AM8

AREA: MAYOR'S CONFERENCE ROOM

ITEM	QTY	DESCRIPTION	COST
23.	6	Four (4") ceiling speakers, with integral transformer. **ATLAS/SONDELIER FC104/T47**	_____
		CONTROL	
24.	Lot	Active matrix color touch screen control panel, portable, RF wireless handheld LCD control panel. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. **AMX CONTROL SYSTEM QUOTE # MAS98D01ER** **CRESTRON CONTROL SYSTEM QUOTE #1054**	_____
		MISCELLANEOUS	
25.	1	Control system shall be connected to Unswitched power and shall be provided with a power line conditioner. **AMERICAN POWER CONVERSION (APC) LINE-R 1250**	_____
26.	1	Rack auxiliary input/output panel **CUSTOM BY AV CONTRACTOR**	_____
27.	2	Equipment rack, black, with vents, blank panels, locking back door, rack shelves, fans and power strips required to complete installation. **MIDDLE ATLANTIC MRK 44-26** ***ALL ACCESSORIES AS REQUIRED***	_____
28.	LOT	Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system. **CUSTOM BY AV CONTRACTOR**	_____

AREA: MAYOR'S CONFERENCE ROOM

ITEM	QTY	DESCRIPTION	COST

The following equipment shall be furnished by the A/V Contractor, and installed by others:

29. LOT Rear screen projection screen, utilizing ¼" acrylic and P2000 framing system; screen to provide a 72" high by 96" wide image. _____

STEWART FILMSCREEN AEROVIEW 100
PERIMETER 2000 FRAMING SYSTEM

30. 1 Electric projection screen with low-voltage control, tab tensioned, ceiling enclosure; viewing area 72"high by 96"wide. _____

STEWART FILMSCREEN ABT 4120

31. 6 Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. _____

ATLAS/SOUNDOLIER E-410 ENCLOSURE
ATLAS/SOUNDOLIER 51-4 GRILLE

AREA: MAYOR'S SUITE

ITEM	QTY	DESCRIPTION	COST

DISPLAY SYSTEMS

1. 2 Video monitor, 21", NTSC flat panel display, with all wall mounting hardware, extension cables, etc. _____

FUJITSU PDS2173B

VIDEO SYSTEM

2. 1 Videocassette player/recorder, ½" S-VHS, rackmounted _____

SONY SVO-1620
MIDDLE ATLANTIC RACK MOUNT

AUDIO SYSTEMS

3. 1 Single channel mixeramplifier, 60 watts into an 8 ohm load, 70 volt, include muteable input modules and rack mounts as necessary. _____

TOA A906MKII

4. 1 Single channel graphic equalizer, rack mountable, with security cover. _____

RANE ME 30B

5. Four (4") ceiling speakers, with integral transformer. _____

ATLAS/SONDELIER FC104/T47

AREA: MAYOR'S SUITE

ITEM	QTY	DESCRIPTION	COST

CONTROL

6. Lot RF wireless handheld LCD control panel. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. _____

AMX CONTROL SYSTEM QUOTE # MAS98D01ER
CRESTRON CONTROL SYSTEM QUOTE #1054

MISCELLANEOUS

7. 1 Control system shall be connected to Unswitched power and shall be provided with a power line conditioner. _____

AMERICAN POWER CONVERSION (APC) LINE-R 1250

8. LOT Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system. _____

CUSTOM BY AV CONTRACTOR

The following equipment shall be furnished by the A/V Contractor, and installed by others:

9. 3 Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. _____

ATLAS/SOUNDOLIER EZ96-4X ENCLOSURE
ATLAS/SOUNDOLIER 51-4 GRILLE

AREA: COMMISSIONER'S SUITE

ITEM	QTY	DESCRIPTION	COST

PROJECTION/DISPLAY SYSTEMS

1. 1 Video/Data Monitor, 37", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control. _____

   NEC MULTISYNC XP37 PLUS (XP3790)

2. 4 Video/Data Monitor, 29", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control. _____

   NEC MULTISYNC XP29 PLUS (XP2990)

VIDEO SYSTEM

3. 2 Universal Analog RGBS computer interface, with digial controls, complete with the monitor breakout cables and RGBS extension cables as required. _____

   EXTRON RGB 300
   EXTRON RGBS EXTENSION CABLES
   EXTRON MBC-SVGA 26-162-01

4. 1 Videocassette player/recorder, ½" S-VHS, rackmounted _____

   SONY SVO-1620
   MIDDLE ATLANTIC RACK MOUNT

5. 2 Scan doubler, with minimum three (3) video/s-video inputs, with audio follow video, multiple format output, RS-232 control, rack mountable. _____

   EXTRON SYSTEM 4LDex

AREA: COMMISSIONER'S SUITE

ITEM	QTY	DESCRIPTION	COST
AUDIO SYSTEMS			
6.	1	Compact disk/cassette combination deck, with separate balanced outputs for each, rack mountable, remote control. **DENON DN-T620**	_____
7.	1	Single channel mixer/amplifier, 60 watts into an 8 ohm load, 70 volt, include muteable input modules and rack mounts as necessary. **TOA A906MKII**	_____
8.	1	Single channel graphic equalizer, rack mountable, with security cover. **RANE ME 30B**	_____
9.	4	Four (4") ceiling speakers, with integral transformer. **ATLAS/SONDELIER FC104/T47**	_____
CONTROL			
10.	Lot	Active matrix color touch screen control panel, portable, located at Commissioner's desk. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. **AMX CONTROL SYSTEM QUOTE # MAS98D01ER** **CRESTRON CONTROL SYSTEM QUOTE #1054**	_____

AREA: COMMISSIONER'S SUITE

ITEM	QTY	DESCRIPTION	COST
		MISCELLANEOUS	
11.	1	Control system shall be connected to Unswitched power and shall be provided with a power line conditioner.	_____
		AMERICAN POWER CONVERSION (APC) LINE-R 1250	
12.	1	Rack auxiliary input/output panel	_____
		CUSTOM BY AV CONTRACTOR	
13.	1	Equipment rack, black, with vents, blank panels, locking back door, rack shelves, fans and power strips required to complete installation.	_____
		MIDDLE ATLANTIC SLIM 5 SERIES **ALL ACCESSORIES AS REQUIRED**	
14.	LOT	Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system.	_____
		CUSTOM BY AV CONTRACTOR	

The following equipment shall be furnished by the A/V Contractor, and installed by others:

15.	4	Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers.	_____
		ATLAS/SOUNDOLIER E-410 ENCLOSURE **ATLAS/SOUNDOLIER 51-4 GRILLE**	

AREA: WATCH COMMAND

ITEM	QTY	DESCRIPTION	COST

PROJECTION/DISPLAY SYSTEMS

1. 8 Video/Data Monitor, 29", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control. _____

NEC MULTISYNC XP29 PLUS (XP2990)

AUDIO SYSTEMS

2. 1 Single channel power amplifier, 60 watts into an 8 ohm load, 70 volt, include muteable input modules and rack mounts as necessary. _____

TOA A906MKII

3. 1 Single channel graphic equalizer, rack mountable, with security cover. _____

RANE ME 30B

4. 10 Four (4") ceiling speakers, with integral transformer. _____

ATLAS/SONDELIER FC104/T47

CONTROL

5. LOT Active matrix color touch screen control panel, LCD control panel. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. _____

AMX CONTROL SYSTEM QUOTE # MAS98D01ER
CRESTRON CONTROL SYSTEM QUOTE #1054

AREA: WATCH COMMAND

ITEM	QTY	DESCRIPTION	COST

MISCELLANEOUS

6. 1 Control system shall be connected to Unswitched power and shall be provided with a power line conditioner. _____

AMERICAN POWER CONVERSION (APC) LINE-R 1250

ALTERNATES

7. 1 Deduct:

Active matrix color touch screen control panel, LCD control panel. _____

8. 1 Add:

PC based control system software and hardware, to allow system control from a local PC.

AMX CONTROL SYSTEM QUOTE # MAS98D01ER
CRESTRON CONTROL SYSTEM QUOTE #1054

The following equipment shall be furnished by the A/V Contractor, and installed by others:

9. 10 Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. _____

ATLAS/SOUNDOLIER E-410 ENCLOSURE
ATLAS/SOUNDOLIER 51-4 GRILLE

10. 8 Ceiling mount hardware for 29" monitors _____

PIVOTELLLI OR APPROVED EQUAL

AREA: PRESS ROOM

ITEM	QTY	DESCRIPTION	COST
DISPLAY SYSTEMS			
1.	2	Video/Data Monitor, 37", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control.	_____
VIDEO SYSTEM			
2.	1	Videocassette player/recorder, ½" S-VHS, rackmounted	_____
		SONY SVO-1620	
AUDIO SYSTEMS			
3.	1	Single channel power amplifier, 60 watts into an 8 ohm load, 70 volt, include input modules and rack mounts as necessary.	_____
		TOA P906MKII	
4.	12	Four (4") ceiling speakers, with integral transformer.	_____
		ATLAS/SONDELIER FC104/T47	
5.	1	Lectern gooseneck microphone, with shock mount.	_____
		CROWN LM300-A	

AREA: PRESS ROOM

ITEM	QTY	DESCRIPTION	COST

CONTROL

6. Lot — RF wireless handheld LCD control panel.
Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. _____

AMX CONTROL SYSTEM QUOTE # MAS98D01ER
CRESTRON CONTROL SYSTEM QUOTE #1054

MISCELLANEOUS

7. 1 — Control system shall be connected to Unswitched power and shall be provided with a power line conditioner. _____

AMERICAN POWER CONVERSION (APC) LINE-R 1250

8. LOT — Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system. _____

CUSTOM BY AV CONTRACTOR

9. LOT — Fiber distribution system, includes broadcast quality video and balanced line level audio, with intercom. Miscellaneous hardware, *switches, relays panels, connectors, cabling, lamps, terminal blocks,* wall plates, etc., necessary to insure a complete and operating system. _____

FORCE QUOTE #Q80406MA

10. 3 — Audio distribution amplifiers, 1 X 20, balanced configuration. _____

SIGMA ELECTRONICS ADA-210

11. 1 — Rack for fiber transceivers/modulators, to be sized by AV contractor _____

MIDDLE ATLANTIC

AREA: PRESS ROOM

ITEM	QTY	DESCRIPTION	COST
12.	1	Wall mounted rack for fiber transceivers/modulators, and connection panels, 22" deep. **MIDDLE ATLANTIC DWR SERIES**	_____

The following equipment shall be furnished by the A/V Contractor, and installed by others:

13.	12	Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. **ATLAS/SOUNDOLIER EZ96-4X ENCLOSURE** **ATLAS/SOUNDOLIER 51-4 GRILLE**	_____
14.	2	*Floor boxes, for carpeted concrete floor, with lift off full access* door and fold back cable exit; 3" depth. **FSR FL-500P FLOOR BOX**	_____
15.	2	Ceiling mount brackets for 37" ceiling mounted monitors, with VCR tray. **PIVOTELLI OR APPROVED EQUAL**	_____
16.	1	Ceiling mounted screen, with tab-tensioned system; viewing area is . 72" high X 96"wide, with low voltage interface. **STEWART MODEL A**	_____

AREA: PIU/TRAINING ROOM

ITEM	QTY	DESCRIPTION	COST
PROJECTION/DISPLAY SYSTEMS			
1.	1	Video/Data Projector, reflective LCD, high light output, multi-frequency input, native 1024 X 768 resolution, RS232 control, with lens, complete with spare lamps.	_____
		SHARP XG-3000	
2.	LOT	Ceiling mount hardware.	_____
		CUSTOM BY AV CONTRACTOR	
3	2	Video/Data Monitor, 37", minimum display resolution 1280 X 1024 resolution, autoscanning, RS232 control.	_____
		NEC MULTISYNC XP37 PLUS (XP3790)	
VIDEO SYSTEM			
4	1	Matrix switcher, 12 X 8 (200 Mhz) with 12 X 8 stereo audio, complete with break-away switching, local control panel, RS232 control, rackmounted.	_____
		EXTRON CROSSPOINT 128HVA	
5.	2	Universal Analog RGBS computer interface, with digial controls, complete with the monitor breakout cables and RGBS extension cables as required.	_____
		EXTRON RGB 300 **EXTRON RGBS EXTENSION CABLES** **EXTRON MBC-SVGA 26-162-01**	
6..	1	Videocassette player/recorder, ½" S-VHS, rackmounted	_____
		SONY SVO-1620 **MIDDLE ATLANTIC RACK MOUNT**	

AREA: PIU/TRAINING ROOM

ITEM	QTY	DESCRIPTION	COST
7.	1	Scan doubler, with minimum three (3) video/s-video inputs, with audio follow video, multiple format output, RS-232 control, rack mountable. **EXTRON SYSTEM 4LDex**	_____

AUDIO SYSTEMS

8.	1PR	Program audio speakers, with internal crossover, mirror image matched left & right, magnetically shielded, with surface mount hardware. **EASTERN ACOUSTIC WORKS JF-50S** **OMNIMOUNT SERIES 75 WALL MOUNT**	_____
9.	2	Dual channel amplifier, 2 X 110 watts into an 8 ohms load, rackmountable. **CROWN CT-210**	_____
10.	1	Single channel power amplifier, 60 watts into an 8 ohm load, 70 volt, include muteable input modules and rack mounts as necessary. **TOA A906MKII**	_____
11.	1	Matrix audio mixer, with presets, RS-232 control; rack mountable. **TOA DX-0808**	_____
12.	1	Audio cassette player/recorder with rackmount **TASCAM 112**	_____
13.	1	Wireless diversity lavalier microphone system, cardioid pick up pattern, with rack mounted receiver. **LECTROSONICS DLS W/M150**	_____

AREA: PIU/TRAINING ROOM

ITEM	QTY	DESCRIPTION	COST
14.	1	Lectern gooseneck microphone, with shock mount. **CROWN LM300-A**	
15.	1	Single channel graphic equalizer, rack mountable, with security cover. **RANE ME 30B**	
16.	1	Dual channel graphic equalizer, rack mountable, with security cover. **RANE ME 15B**	
17.	6	Four (4") ceiling speakers, with integral transformer. **ATLAS/SONDELIER FC104/T47**	
CONTROL			
18.	Lot	Active matrix color touch screen control panel, portable, RF wireless handheld LCD control panel. Master card frame, interface modules, relay cards, IR/serial interfaces, control cables, power supplies, etc., system programming to perform all control functions as required. Nomenclature to be coordinated with client/operator Include analog modem (56kbs) for remote diagnostics. **AMX CONTROL SYSTEM QUOTE # MAS98D01ER** **CRESTRON CONTROL SYSTEM QUOTE #1054**	

AREA: PIU/TRAINING ROOM

ITEM	QTY	DESCRIPTION	COST

MISCELLANEOUS

19. 1 Control system shall be connected to Unswitched power and shall be provided with a power line conditioner. _____

AMERICAN POWER CONVERSION (APC) LINE-R 1250

20. 1 Rack auxiliary input/output panel _____

CUSTOM BY AV CONTRACTOR

21. 2 Equipment rack, black, with vents, blank panels, locking back door, rack shelves, fans and power strips required to complete installation. _____

MIDDLE ATLANTIC MRK 44-26
ALL ACCESSORIES AS REQUIRED

21. LOT Miscellaneous hardware, switches, relays panels, connectors, cabling, lamps, terminal blocks, wall plates, etc., necessary to insure a complete and operating system. _____

CUSTOM BY AV CONTRACTOR

The following equipment shall be furnished by the A/V Contractor, and installed by others:

22. 1 Electric projection screen with low-voltage control, tab tensioned,; viewing area 72"high by 96"wide. _____

STEWART FILMSCREEN MODEL A

23. 6 Ceiling back boxes and grills for Atlas/Soundolier ceiling speakers. _____

ATLAS/SOUNDOLIER E-410 ENCLOSURE
ATLAS/SOUNDOLIER 51-4 GRILLE

24. 2 Ceiling mount brackets for 37" ceiling mounted monitors. _____

PIVOTELLI OR APPROVED EQUAL

AREA: HEAD END SYSTEM

ITEM	QTY	DESCRIPTION	COST
VIDEO SYSTEM			
1	7	Video tuner, cable ready, RS232 control, rackmounted. **SONY SONY TU-1042**	_____
2.	7	Scan doubler, with minimum three (3) video/s-video inputs, with audio follow video, multiple format output, RS-232 control, rack mountable. **EXTRON SYSTEM 4LDex**	_____
3.	LOT	Video matrix switch, framed for 144 X 144, sub-populated to 144 X 80, local control panel, RS232 control, rackmounted.. ***PESA QUOTE #9804027BH***	_____
4.	LOT	Head end/RF distribution system, for ninety channel system, expandable. Include all signal processors, modulaters, amplifiers, taps, etc. to make a comlete and working system. ***BLONDER TONGUE QUOTE #98721***	_____
5.	1	Verification/quality monitor, 19" display, rackmountable. **SONY PVM-20N1U W/SLR-103A RAIL KIT**	_____
6.	10	Equipment rack, black, with vents, blank panels, locking back door, plexi-glas front door, rack shelves, fans and power strips required to complete installation. **MIDDLE ATLANTIC MRK 44-26** **ALL ACCESSORIES AS REQUIRED**	_____

SECTION VII

RECAPITULATION

MASTER RECAPITULATION OF COST

ROOM	EQUIPMENT	ENGINEERING	PRE-INSTALL	INSTALL	TAX	G&A	SUB TOTAL
Emergency Operations Center							
Mayor's Conference Room							
Mayor's Suite							
Commissioner's Suite							
Watch Command							
Press Room							
PIU/Training Room							
Head End/RF Distribution							
Total							

MASTER RECAPITULATION OF COST (continued)

Service Contract (2nd Year) $_____

Hourly Rate $_____

O.T. Rate $_____

Emergency Rate: $_____

(End of Section VII)

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SECTION 11450 - PANTRY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide pantry equipment in accordance with the Contract Documents. The Work of this Section shall include but not be limited to the following:

1. Upright refrigerator/freezer units.

2. Commercial dishwasher units.

3. Instant hot water dispenser.

4. Microwave oven units.

5 Undercounter refrigerator/freezer.

B. Related Sections

1. Section 06100 - Rough Carpentry.
2. Section 06400 - Architectural Woodwork.
3. Divisions 15 - Plumbing Work.
4. Division 17 - Electrical Work.

1.2 SUBMITTALS

A. Product data for each appliance type required indicating compliance with requirements, including installation instructions. Provide complete operating and maintenance instructions for each appliance.

B. Schedule: Submit schedule of appliances, using the same room designations as shown on drawings.

C. Example of required format for appliance schedule is included in last article of this Section.

1.3 QUALITY ASSURANCE

A. Energy Ratings: Provide appliances that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.

1. UL and NEMA Compliance: Provide electrical components required as part of appliances that are listed and labeled by UL and comply with applicable NEMA standards.

B. AHAM Standards: Provide appliances that conform to the following standards of the Association of Home Appliance Manufacturers:

1. Refrigerators and Freezers: Total volume and shelf area ratings certified according to ANSI/AHAM HRF-1.

C. Single-Source Responsibility: Obtain appliances from a single supplier.

1. *Provide products from the same manufacturer for each* type of appliance required.

2. To the greatest extent possible, provide appliances by a single manufacturer for entire Project, unless otherwise indicated.

D. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of appliances and are based on the specific types and models indicated. Appliances by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.4 DELIVERY AND STORAGE

A. Deliver appliances to the Project site in the manufacturer's undamaged protective packaging.

B. Delay delivery of appliances until utility rough-in is complete and construction in the spaces to receive appliances is substantially complete and ready for installation.

1.5 WARRANTIES

A. Warranty: Submit written warranties executed by the manufacturer of each appliance specified agreeing to repair or replace units or components that fail in materials or workmanship within the specified warranty period.

1. Microwave Oven: 9-year limited warranty on defects in the magnetron tube.

2. Refrigerator/Freezer: 5-year warranty on the sealed refrigeration system.

3. Dishwasher: 5-year warranty on the dishwasher motor, pump and hot water booster; 10-year warranty against rust on stainless steel components.

B. Warranties specified above shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering appliances that may be incorporated in the Work include, but are not limited to, the following:

1. General Electric Company.
2. Whirlpool Corporation.
3. Jackson Products Company.
4. Elkay Manufacturing Company.

2.2 REFRIGERATOR/FREEZERS

A. Top-Mount Refrigerator/Freezer: Provide a freestanding, frost-free, two-door, top-mount model refrigerator/freezer on adjustable rollers, with five shelves minimum in each door.

1. Capacity: Provide the following minimum values, measured according to ANSI/AHAM HRF-1 and certified by AHAM:

   a. Total volume: 14.4 cu. ft.
   b. Refrigerator volume: 10.58 cu. ft.
   c. Freezer volume: 3.86 cu. ft.
   d. Total shelf area: 19.6 sq. ft.

2. Energy Consumption: Manufacturer's standard high energy efficiency units; 20 percent below standard energy consumption.

3. Temperature Controls: Include separate temperature controls for each compartment and a switch for condensation-control heating element at the freezer opening.

4. Storage Features: Provide the following standard storage features:

   a. Adjustable glass interior cabinet shelves.
   b. Meat compartment.
   c. Vegetable crisper.
   d. Butter conditioning compartment.
   e. Removable egg trays.
   f. Two ice cube trays.
   g. Automatic icemaker.

2.3 DISHWASHERS

A. Free-Standing, Commercial Quality Dishwasher: Provide a free-standing stainless steel automatic dishwasher with a hot water booster. Provide units approximately 24" wide x 34" high x 2 deep. Dishwasher shall be fabricated of Type 304 (18-8) all-stainless-steel construction, and be operable at water pressures from 20 psi (minimum) and shall not require a water usage rate of 26.4 gal/hr. Provide units with a 6.7 KW electric water booster, and a 3/4 hp pump motor. Include full-extension, dish rack and silverware rack. Provide sound-absorbing exterior insulation blanket around tub and back to reduce noise. Include soft food disposer and self-cleaning food filter system.

1. Wash Cycle: Provide dishwasher unit with automatic wash cycle.

2. Dry Cycles: Provide dishwasher unit with hot-air drying cycle.

3. Control Type: Rotary dial, turn-to-start type, unless otherwise indicated.

2.4 UNDERCOUNTER HOT WATER DISPENSER

A. General: Provide an electrically operated, self-contained, hot water dispensing system; capable of dispensing approximately 60 cups of 190 degree F. water/hour. System shall have an integral line pressure-free (vented) 0.65 gallon water tank reservoir, and deck-mounted safety-dispensing valve assembly.

1. Provide units which operate on 120 volts, 60 Hz., 750 watts.

2.5 MICROWAVE OVENS

A. Microwave Ovens, General: Provide 120 volt service input at 1300 watts, 12.5 amps and 60 cycles with 800 watts of power output; 10 power levels; 0.8 cu. ft. capacity; timer.

2.6 UNDER-COUNTER REFRIGERATOR/FREEZER

A. Under-Counter Refrigerator/Freezer: Provide a freestanding, single-door, under-counter model refrigerator/freezer on adjustable rollers, with two shelves minimum in each door.

1. Capacity: Provide the following minimum values, measured according to ANSI/AHAM HRF-1 and certified by AHAM:

   a. Total volume: 5.1 cu. ft.
   b. Refrigerator volume: 4.4 cu. ft.
   c. Freezer volume: 0.7 cu. ft.

2. Temperature Controls: Include separate temperature controls for each compartment and a switch for condensation-control heating element at the freezer opening.

3. Storage Features: Provide the following standard storage features:

a. Adjustable interior wire shelves.
b. Freezer compartment.
c. Two ice cube trays.
d. Built-in egg trays.
e. Two built-in door storage shelves.

2.7 FINISHES

A. General: Provide the manufacturer's standard porcelain enamel finish.

B. Colors: Provide manufacturer's standard colors as shown or scheduled. If no color indicated, provide white.

1. Wherever appliances by more than one manufacturer are installed in the same space, provide units with color matching largest equipment item.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations.

B. Built-In Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.2 ADJUST AND CLEAN

A. Testing: Test each item of residential equipment to verify proper operation. Make necessary adjustments.

B. Accessories: Verify that accessory items required have been furnished and installed.

C. Cleaning: Remove packing material from residential equipment items and leave units in clean condition, ready for operation.

3.3 APPLIANCE SCHEDULE

A. General: Provide the following appliance in locations as indicated on the drawings and schedules.

1. EQ-01:

Description	:	Top-Mount Refrigerator/Freezer.
Manufacturer	:	General Electric
Series	:	"D" Series.
Model	:	#TBH14DAX
Color	:	White, unless otherwise indicated.

2. EQ-02:

Description	:	Under-Counter Microwave Ovens
Manufacturer	:	General Electric
Model	:	#JEM25WV
Color	:	White, unless otherwise indicated.

3. EQ-03:

Description	:	Commercial Dishwashers
Manufacturer	:	Jackson Products Company.
Model	:	#JP-24B
Color	:	Stainless steel No. 4, unless otherwise indicated.

4. EQ-04:

Description	:	Undercounter Hot Water Dispenser
Manufacturer	:	Elkay Manufacturing Company.
Model	:	#LKH-180
Color	:	Polished Chrome, unless otherwise indicated.

5. EQ-05:

Description	:	Under-Counter Refrigerator/Freezer.
Manufacturer	:	Sub Zero
Model	:	#249R
Panel	:	Custom millwork panel matching cabinetry; refer to "Section 06400 - Architectural Woodwork.'

END OF SECTION

SECTION 12500 - WINDOW TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide window treatment in accordance with the Contract Documents. The Work of this Section shall include but not be limited to the following:

1. Dual fabric-type roller shades, electrically operated.

2. Single fabric-type roller shades, manually and electrically operated.

B. Related Sections

1. Section 09250 - Gypsum Board Assemblies.
2. Section 09511 - Acoustical Panel Ceilings.
3. Division 16 - Electrical Work.

1.2 QUALITY ASSURANCE

A. Single Source Responsibility: Provide window shade units which are complete assemblies produced by a single manufacturer.

B. Installer Qualifications: Installation of window treatments shall be performed by an installer who has a minimum of (2) years successful experience with installations of this type and who is approved by the shade manufacturer.

C. Surface Burning Characteristics: Provide products identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organizations.

1. Testing Method: ASTM E 84.
2. Flame Spread: 25 or less.
3. Smoke Development: 450 or less.

4. Include details of shade pocket assemblies indicating size, profile, and interface of window treatments.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for type of shade specified.

B. Shop Drawings: Submit shop drawings of shade units showing locations and extent of window treatments and showing details of attachment to supporting substrates and relationship to adjoining work.

1. Include elevations indicating divisions between shade units.

2. Include typical elevation of shade showing relationship between shade and the head jambs and sill of opening.

3. Include wiring diagram for motor-operated shades.

C. Samples: Submit sample of each component, material and finish which will be exposed to view. Samples shall be from same materials to be used in the Work.

1. Submit samples of each shade fabric. Samples shall be full width of fabric by (1) one yard long and shall include typical welded seam.

D. Maintenance Manuals: Provide maintenance manuals showing methods of repair and replacement of shade fabric and mechanism.

1.4 TESTING

A. Fire Performance: Submit certified test reports evidencing compliance with fire performance requirements of NFPA 701, small scale vertical burn test.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver window treatments to project site in protective wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and installation location.

1. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling and extreme temperatures, and humidity.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.6 SEQUENCING AND SCHEDULING

A. Sequence shade installation with other work to minimize possibility of damage and soiling during remainder of construction.

1.7 WARRANTY

A. Provide special project warranty agreeing to repair or replace shades that do not operate properly within a 3 year period following substantial completion of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturer: Subject to compliance with requirements, manufacturer's offering window treatments which may be incorporated in the work include one of the following, or approved equal.

1. MechoShade Systems, Inc.
2. The Graber Company
3. D.F.B. Sales Inc.
4. Draper Shades & Screen Co.

B. Selected Products: Subject to compliance with requirements, provide the following window treatment assemblies, or approved equal:

1. Dual Fabric-Type Roller Shades: Provide motorized "Dual Shades" consisting of double-roller solar mesh /black-out assemblies, as manufactured by MechoShade Systems, Inc.

2. Single Fabric-Type Roller Shades: Provide motorized "ElectroShade" window treatment consisting of single-roller fabric cloth assemblies, as manufactured by MechoShade Systems, Inc.

3. Single Fabric-Type Roller Shades: Provide manually operated "MechoShade" window treatment consisting of single-roller fabric cloth assemblies, as manufactured by MechoShade Systems, Inc.

2.2 DOUBLE ROLLER TYPE SHADES

A. General: The shade system shall be a double roller, dual fabric-type system with a smooth operating roller system which incorporates an adjustable slip clutch to control the rate of fall for a free running zero friction factor with infinite preset positions, and a pair of solid state in-the-roller motor operators; as selected by the Architect.

1. Shade unit shall be of the sizes required to fit existing openings and as determined by field measurement.

2. Dual-shades shall consist of two independently operated roller assemblies, each fashioned with a separate shade fabric, as follows:

a. Solar Shade: ASTM D 1925; vinyl-coated polyester yarn. Shade fabric shall be free from defects including, but not limited to, runs, tears, and warp and weft not perpendicular to each other. Fabric approved by Architect from manufacturer's standard selection; fabric shall comply with flame retardance requirements of City of New York.

i) Provide manufacturer's standard basket weave fabric shade cloth, with a 13% openness factor, of color matching the Architect's samples, unless otherwise indicated.

b. Black-Out Shade: Provide the manufacturer's standard series opaque, colored vinyl material of colors as selected by the Architect.

B. Shade Rollers: Extruded 6063-XT6 aluminum tubes, 1-1/2" diameter with integral keyways to receive tubular motors as indicated, and extruded with two fabric mounting channels per roller.

C. Mounting Brackets: 1/8" thick sheet steel; wall jamb or ceiling mounted as indicated. Center support brackets as required to span or weight loads.

D. Shade Pockets: Provide manufacturer's standard extruded aluminum shade pocket assemblies of the sizes and configurations necessary to house the double roller shade system.

1. Provide shade pocket assemblies similar to "#4123" as manufactured by MechoShade Systems Inc., or approved equal.

E. Motors: Motors shall be the manufacturer's standard in-the-roller type, asynchronous single phase motors with built in adjustable limit switches to regulate the upper and lower stopping positions. They shall be thermally protected and UL approved. Motors shall be 120V, 60 hz., and wired with double pole switches, unless otherwise indicated.

2.3 SINGLE ROLLER TYPE SHADES

A. General: The shade system shall be a single roller, single fabric-type system with a smooth operating roller system which incorporates an adjustable slip clutch to control the rate of fall for a free running zero friction factor with infinite preset positions, and a solid state in-the-roller motor operators; as selected by the Architect.

1. Shade unit shall be of the sizes required to fit existing openings and as determined by field measurement.

2. Electric shades shall consist of a roller assemblies, fashioned with a the following shade fabric:

   a. Solar Shade: ASTM D 1925; vinyl-coated polyester yarn. Shade fabric shall be free from defects including, but not limited to, runs, tears, and warp and weft not perpendicular to each other. Fabric approved by Architect from manufacturer's standard selection; fabric shall comply with flame retardance requirements of City of New York.

      i) Provide manufacturer's standard basket weave fabric shade cloth, with a 13% openness factor, of color matching the Architect's samples, unless otherwise indicated.

B. Shade Roller: Extruded 6063-XT6 aluminum tube, 1-1/2" diameter with integral keyway to receive tubular motor as indicated, and extruded with two fabric mounting channels per roller.

C. Mounting Brackets: 1/8" thick sheet steel; wall jamb or ceiling mounted as indicated. Center support brackets as required to span or weight loads.

D. Shade Pockets: Provide the manufacturer's standard shade pocket assembly fabricated of extruded aluminum, complete with brackets and closures. Pocket assemblies shall be of the sizes and configurations necessary to house the roller shade system.

   1. Selected Product: Provide shade pocket assembly "#4123" as manufactured by MechoShade Systems Inc., or approved equal.

E. Motors: Motors shall be the manufacturer's standard in-the-roller type, asynchronous single phase motors with built in adjustable limit switches to regulate the upper and lower stopping positions. They shall be thermally protected and UL approved. Motors shall be 120V, 60 hz., and wired with double pole switches, unless otherwise indicated.

2.4 METAL FINISHES

A. All exposed steel surfaces shall be finished in manufacturer's standard baked-enamel finish in custom color selected by Architect; all exposed aluminum and other metal surfaces shall be factory primed and field painted. Refer to Section 09900 - Painting for requirements.

2.5 FABRICATION AND OPERATION

A. Verify actual opening dimensions prior to fabrication, by site measurements. Do not proceed with fabrication until unsatisfactory conditions have been resolved. Adjust dimensions of window treatments for proper fit at openings. Cooperate with other trades for securing mounting brackets to substrates and other finished surfaces.

B. Fabricate shade assemblies from noncorrosive materials which do not require lubrication during the normal expected life.

C. Fabricate shade units as specified herein to completely fill openings.

D. For continuous installations, fabricate units so that breaks between units occur only at mullions or other defined vertical separation.

E. No vertical seams are permitted in shade fabric; where horizontal seams are required, fabric shall be "railroaded" and seam shall occur as close to top of shade as possible when shade is fully extended. All window treatments in a room shall have railroaded fabric if one shade in that room is required to have railroaded fabric.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site at which the shade units is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install shade units in reverse roll manner indicated to comply with manufacturer's instructions. Position units level and plumb; secure and at the proper height and location relative to adjoining units and other related work. Securely anchor units with proper clips, brackets and anchorages, suited to type of mounting indicated.

B. Provide adequate provision for unencumbered operation of units.

C. Shade brackets shall be attached to ceiling construction as indicated on drawings. There shall be no standard fascia piece.

D. Isolate metal parts of shade units from concrete or mortar to prevent galvanic action.

3.3 FIELD TESTING

A. Test operation of each shade unit assembly, and adjust those which do not operate smoothly.

3.4 CLEANING

A. Remove and dispose of debris, cartons and other materials used in installation.

3.5 PROTECTION

A. Protect tested and installed units to ensure optimum operating conditions without damage, blemishes or indication of use at completion of project. Repair or replace damaged or otherwise defective units.

3.6 MAINTENANCE INSTRUCTION

A. After completion of the shade installation, instruct the Owner's personnel in the proper maintenance and replacement procedures. Demonstrate repair and replacement techniques.

3.7 SCHEDULE

A. General: Provide the following window treatment assemblies where indicated on the drawings and schedules.

1. WT-01:

Manufacturer	:	MechoShade Systems Inc.
Model	:	Dual-Shade.
Fabrics	:	Provide black-out and solar (basket-weave) fabrics matching the Architect's samples.
Colors	:	As selected by the Architect.
Operation	:	In-Roller Motor Operators; Electrically.

2. WT-02:

Manufacturer	:	MechoShade Systems Inc.
Model	:	ElectroShade.
Fabrics	:	Provide basket-weave fabrics matching the Architect's samples.
Colors	:	As selected by the Architect.
Operation	:	In-Roller Motor Operators; Electrically.

3. WT-03:

Manufacturer	:	MechoShade Systems Inc.
Model	:	MechoShade.
Fabrics	:	Provide basket-weave fabrics matching the Architect's samples.
Colors	:	As selected by the Architect.
Operation	:	Manually.

END OF SECTION

SECTION 12611 - WORKSTATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide workstations in accordance with the Contract Documents. The work of this Section shall include but not be limited to the following:

1. Free standing modular workstation furniture system complete with the following:

   Prefinished furniture quality steel framing/supports.
   Plastic laminate clad console (adjustable).
   Plastic laminate clad particleboard worksurfaces.
   Slatwall spine.
   Shelving and storage assemblies.
   Integral data and communication management systems.
   Natural wood veneer clad aluminum trims.
   Installation and accessory hardware.

B. Related Sections

1. Section 06100 - Rough Carpentry.
2. Section 06400 - Architectural Woodwork.
3. Divisions 16 - Electrical Work.
4. Division 17 - Telecommunications Work.

1.2 SYSTEMS DESCRIPTION

A. Provide modular workstation systems furniture with the following performance requirements:

1. System designed for ease of field assembly, accomplished with minimum of tools and no special hardware.

   a. Provide non-handed components, including panels and support structures capable of being easily reversed without the use of additional or special hardware.

B. Provide complete system with modular components of workstation system furniture including but not limited to panels, panel connectors, bases, worksurfaces, consoles, storage cabinets, pedestals, drawers, installation brackets, communication and wiring management baskets, grommets, hardware and accessories.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of component and installation accessory specified. Include methods of installation for each type of special connection condition appearing on drawings. Provide written data on structural capabilities of all load carrying components.

B. Maintenance Data: Include necessary data for maintenance of system.

C. Shop Drawings: Submit shop drawings based upon Architect's design drawing showing details and dimensions of all special components which are not fully detailed and dimensioned in manufacturer's literature. Submit detail drawings of wire management systems and wiring provisions. Submit plan and elevation drawings in addition to schedules showing component locations.

D. Samples for Verification Purposes: Submit the following samples, for Architect's approval prior to manufacturing, prepared from same material to be used for the work.

1. 12" square samples of each plastic laminate clad work surface.

2. 12" square samples of each wood veneer laminated aluminum trim.

3. 12" square samples of exposed, pre-finished steel framing.

4. Full size samples of each hardware and accessory item including wire management baskets, grommets, interconnecting hardware.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm specializing in modular workstation system furniture installation with not less than 2 years of experience installation of systems furniture similar to that required by the project.

B. Single Source Responsibility: For each type to be installed provide modular systems furniture components produced by a single manufacturer.

C. Fire Resistance Requirements: Provide components which pass Class A requirements of ASTM E-84.

D. Reference Standard: Provide components which meet requirements of "First Generation Voluntary Panel Systems Standard," as published by the Business and Institutional Furniture Manufacturers Association (BIFMA).

E. Custom Fabrications: All custom items must be of quality comparable to standard modular systems furniture components from that manufacturer.

F. Certification: Submit manufacturer's certificate stating that material furnished complies with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements for support capability and fire resistance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with instructions and recommendations of manufacturer for special delivery, storage and handling requirements.

1.6 SEQUENCING AND SCHEDULING

A. Sequence modular system furniture installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.7 WARRANTY

A. Special Project Warranty: Submit a written warranty agreeable to the Installer and the Manufacturer, for repair or replacement of components which fail in materials or workmanship within the specified warranty period.

1. Warranty period is 5 years after the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements provide modular workstation furniture systems as manufactured by Novalink Ltd., or approved equal.

2.2 MATERIALS

A. General: Provide modular system furniture of standard construction with details, finishes and materials consistent throughout. All items of modular system furniture must be free from sharp edges, burrs or other defects which compromise the operation or are harmful to persons or materials in contact with them.

B. Core Material: High-density particle board with compressed top and bottom surface, minimum 45 lbs. density.

1. Provide the manufacturer's standard high pressure plastic laminate cladding matching the Architect's sample.

2. Provide the manufacturer's standard p.v.c. edge banding trim of color selected by the Architect.

C. Edge Details: Provide eased edge detailing except at leading edge of worksurface. Provide straight edge at worksurface leading edge.

D. Steel Components: Fabricate of cold-rolled stretcher-level steel sheet, unless otherwise indicated. Grind seams smooth and flush, zinc coat finished spot welds where required.

1. Provide steel sheet not less than 18 gage thick, unless otherwise indicated.

2. Fabricate the modular furniture system "spline" and "console" assemblies of not less than 11 gage steel.

a. Double and triple the steel sheet assemblies at tension and fastening points and other locations, as recommended by the Architect.

E. Aluminum Components: Fabricate of aluminum extrusions of the alloy and temper and profile as recommended by the system manufacturer. Grind welded seams smooth and flush, finished welds with paint finish specified.

1. Provide extrusions with a minimum wall thickness of 3/16 inch, unless otherwise acceptable to the Architect.

F. Connectors and Fasteners: Provide metal bayonet type component mounting hardware, concealed from view, with safety locking feature to prevent accidental dismantling. Provide components capable of being installed and dismantled without damage to panels or adjacent surfaces.

G. UL Certification: Provide electrical components which are UL listed.

H. Panels: Provide non-progressive load-bearing "floating" frame system standard with the system manufacturer. Provide ability to remove any panel from a run of panels without disturbing adjacent panels. Equip system with removable surface panels to permit access to wire management system. Surface panels removable without tools. Identical construction and capability of both straight and radius sections.

I. Frame: Where frames are used they are to be minimum 14 gage cold-rolled steel welded to form rigid structure, incorporating all load-bearing pilasters, together with leveling and connecting fittings for attachment of skin surface.

1. Provide a shop applied painted finish matching the Architect's sample. One-piece frame construction full height of panel.

2. Height as indicated.

J. Panel-to-Panel Connections: Where required provide concealed panel-to-panel connections without intermediate components, and within finished panel structure. Connecting post allowed only at 90 deg, three-way and four-way connections.

K. Provide vertical adjustment channels at 1" intervals along full panel height; to allow for incremental console adjustment.

L. Provide panel base plates of minimum 18 gage roll-formed steel, 4" high with knock-outs to receive back-to-back electrical outlets as required. Provide removable steel cap at both top and exposed ends. Width of cap to match panel dimensions.

1. Panel Height: As indicated.

2. Panel Width: As indicated.

M. Provide panel with the following face finish:

1. Painted steel "slatwall" unless otherwise indicated.

N. Worksurfaces: Provide worksurface components designed to support 200 lbs. with less than 3/16" deflection over 72".

1. Support: Mount on panel on cantilevered, concealed brackets or on fixed or adjustable base cabinets as indicated.

2. Access: Construct worksurface to permit full access to cable duct located at rear of surface and to accept keyboard tray or center drawer at any position.

3. Worksurface Depth: As indicated.

4. Worksurface Width: As indicated.

5. Worksurface Finish: High pressure laminate with p.v.c. edge banding matching the Architect's sample.

6. Grommets: Provide manufacturer's standard grommet and cover assemblies, in material, size and color selected by Architect.

   a. Locations to be indicated in shop drawings.

O. Accessories

1. Cable and Wire Management: Provide wire basket type cable and wire management system consisting of horizontal low voltage cable conduit located at rear of each worksurface and integral with the spline assemblies.

2. Electrical Provisions: Refer to Division 16 - Electrical Work.

3. Telecommunication Provisions: Refer to Division 17 - Telecommunication Work.

4. Keyboard Tray: Provide adjustable computer keyboard pad, in locations indicated on drawing, with minimum vertical adjustment capability of 4", 355 degree rotation, forward tilt to 10 degrees. Keyboard provided with ability to lock into any position, retracting fully under worksurface, raising into position level with desk top. Nominal keyboard dimensions are 20" wide, 8" deep, 2 1/2" high. Finish color black.

   a. Locations to be indicated on shop drawings.

5. Connectors: Provide straight, 2-way, 3-way, 4-way corner panel connectors, high-low connectors, end caps and trim fillers to provide workstation configurations and overall finished installation as indicated. Use drawings of workstation configurations to determine locations of connectors and trim hardware. System manufacturer is responsible for final hardware count.

2.3 FINISHES

A. Wood Veneer Finish: Provide components as scheduled in selected cherry wood veneer over aluminum extrusions; cherry veneer shall match Architect's sample. Finish natural wood veneer clad extrusions with the manufacturer's standard transparent. Finish to match Architect's sample.

B. Factory Applied Painted Metal Finish: Provide environmentally friendly acrylic emulsion - metallic paint finish "Ferroxtone" by Bollen International, or approved Eequal.

1. Color: "FX 99 - Blue Steel", unless otherwise selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which modular systems furniture will be installed. Verify locations of power feeds, positioning of exits and aisleways and overall dimensions of space and systems installation. Do not proceed with installation until such conditions have been corrected to comply with requirements indicated in Contract Documents.

3.2 PREPARATION

A. Prior to installation of systems furniture, vacuum floor surface to remove dust, debris and loose particles.

B. Verify that components, including size and finish, are those specified before installing.

3.3 INSTALLATION

A. Install systems furniture and accessories after finishing operations, including painting have been completed.

B. Install systems furniture to comply with final layout drawings in strict compliance with manufacturer's printed instructions. Position units level, plumb; at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation and smooth operation of moving parts without binding or racking.

3.4 FIELD QUALITY CONTROL

A. Remove and replace components which are chipped, scratched, or otherwise damaged, which do not match adjoining work or do not operate properly.

B. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.5 CLEANING

A. Immediately upon completion of systems furniture installation, clean components and surfaces.

B. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION

A. Upon completion of installation of systems furniture units, test to demonstrate capability and compliance with requirements. Replace any units which do not operate smoothly.

3.7 PROTECTION

A. Protect systems furniture against damage during remainder of construction period.

END OF SECTION

HEATING, VENTILATING & AIR CONDITIONING

TABLE OF CONTENTS

ARTICLE	TITLE	PAGE NO.
SECTION 15100 - GENERAL		
1.1	Reference to General Conditions	15100-1
1.2	Scope of Work	15100-1
1.3	Codes, Permits and Inspections	15100-1
1.4	Guarantees and Certifications	15100-2
1.5	Shop Drawings and Other Information Required	15100-2
1.6	Separation of Work Between Trades	15100-4
1.7	Record Drawings	15100-9
1.8	Technical Definitions	15100-10
1.9	Interpretation of the Drawings & Specifications	15100-11
1.10	Cleaning & Protecting	15100-12
1.11	Testing & Balancing	15100-13
1.12	Equipment & Materials	15100-16
1.13	Access Doors in Finished Construction	15100-17
1.14	Operating & Maintenance Instructions	15100-17
1.15	Tools	15100-18
1.16	Identification	15100-18
1.17	Electrical Motors, Motor Controls & Wiring	15100-20
1.18	Connections to Existing Work	15100-20
1.19	Miscellaneous Fire Protection & Sealing	15100-20
1.20	Fire and Smoke Detection	15100-21
1.21	Testing of Fire Safety Systems	15100-21
1.22	Verifying Existing Conditions, Removals and Alternates	15100-22
1.21	Removals and Alterations	15100-22
SECTION 15110 - PIPING SYSTEMS		
1.1	Piping Systems - General	15110-1
1.2	Materials for Pipe	15110-2
1.3	Material for Fittings	15110-3
1.4	Valves	15110-5
1.5	Strainers	15110-11
1.6	Welding Procedure	15110-12
1.7	Hangers, Supports	15110-13
1.8	Sleeves & Escutcheons for Piping	15110-15
1.9	Centrifugal Pumps	15110-18
1.10	Water Treatment and Chemical Cleaning (Water Systems)	15110-19
1.11	Thermometers and Pressure Tests Connections	15110-19
1.12	Installation of Appurtenances and Sensors in Piping	15110-19

ARTICLE	TITLE	PAGE NO.
SECTION 15120 - AIR DISTRIBUTION SYSTEMS		
1.1	Sheet Metal Ductwork	15120-1
1.2	Dampers for Balancing	15120-5
1.3	Access Doors in Sheet Metal Work	15120-6
1.4	Dampers for Fire Protection	15120-6
1.5	Flexible Connections	15120-8
1.6	Air Intakes and Discharges	15120-8
1.7	Air Distribution Devices	15120-8
1.8	Single Duct Variable Air Volume Units (Pneumatic)	15120-10
1.9	Centrifugal Fans	15120-12
1.10	Pans and Drains Over Electrical Equipment	15120-12
1.11	Fan Powered Terminal Devices (Electric Heat) (Pneumatic Actuator)	15120-13
SECTION 15130 - INSULATION		
1.1	General Insulation Requirements	15130-1
1.2	Insulation for Piping	15130-2
1.3	Insulation for Sheet Metal	15130-4
SECTION 15140 - ACOUSTICAL TREATMENT & VIBRATION ISOLATION		
1.1	Acoustical Treatment	15140-1
1.2	Foundations & Vibration Isolation	15140-3
1.3	Mounting of Ceiling Supported Packaged Air Handling Untis, Tubular Arrangement 9 Fans and Belted Vent Sets - Mounting Type Vii	15140-4
1.4	Mounting of Centrifugal Pumps (Greater than 3 Hp)	15140-5
1.5	Mounting of Centrifugal Pumps (3 Hp or Less)	15140-6
1.6	Support of Piping	15140-6

ARTICLE	TITLE	PAGE NO.
SECTION 15150 - CONTROLS & INSTRUMENTATION		
1.1	Automatic Controls	15150-1
1.2	Sequences of Operation	15150-2
SECTION 15190 - MISCELLANEOUS		
1.1	Packaged Air Conditioning Unit	15190-1
1.2	Supplementary Units	15190-1
1.3	Cooling Tower - Industrial Fluid Coolers	15190-2
1.4	Diesel Emergency Generator - Integral Radiator	15190-4
1.5	Electric Duct Heaters	15190-9
1.6	Propeller Type Unit Heaters (Electric)	15190-10

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SECTION 15100 - HVAC - GENERAL

1.1 REFERENCE TO GENERAL CONDITIONS

A. The General Conditions shall be considered as forming a part of the specifications and shall be carefully examined before proposals for any work are submitted. Unless the specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions, the specifications shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions.

1.2 SCOPE OF WORK

A. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotations.

1.3 CODES, PERMITS AND INSPECTIONS

A. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over construction work at the project.

B. All required permits and inspection certificates shall be obtained, paid for, and made available at the completion of the work.

C. Any portion of the work which is not subject to the approval of an authority having jurisdiction, shall be governed by the applicable sections of the overall National Fire Code, as published by the National Fire Protection Association.

D. Installation procedures, methods, and conditions shall comply with the latest requirements of The Federal Occupational Safety and Health Act (OSHA).

E. All equipment shall comply with "Materials & Equipment Acceptance Division" of N.Y.C. and Board of Standards and Appeals, and/or the Advisory Board of the Bureau of Gas and Electricity as applicable. Filing and approvals of such equipment shall be the responsibility of this trade. If equipment is substituted for manufacturers model numbers shown on the contract documents and filed with the building department and/or Advisory Board, this trade shall have the responsibility of preparing and filing amendments with the Building Department. Application for Use Permits shall be filed by this trade.

F. Prepare and submit to the WTC - Port of Authority of New York and New Jersey a set of "as-built" record drawings for approval, in a form acceptable to the building department.

G. This Contractor shall be responsible for the installation and filing until the installation has been approved by the authorities having such jurisdiction.

1.4 GUARANTEES AND CERTIFICATIONS

A. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.

B. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use. For example, in the case of refrigeration systems, it means that the plant has a cooling load. Similarly, for all other systems.

C. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

D. Non-durable replaceable items such as air filter media do not require replacement after the date of acceptance. If received in writing, requests to have earlier acceptance dates established for these items will be honored.

E. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of heating and air conditioning equipment.

1.5 SHOP DRAWINGS AND OTHER INFORMATION REQUIRED

A. Prior to purchasing any equipment or materials, a list of their manufacturers shall be submitted for review.

B. Prior to assembling or installing the work, the following shall be submitted for review:

1. Scale drawings indicating insert and sleeve locations if required by Architect or Structural Engineer.

2. Scale drawings showing all piping and duct runs with sizes, elevations and appropriate indication of coordination with other trades. This submission to us shall consist of one sepia and 2 paper prints.

3. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment.

C. Documents will not be accepted for review unless:

1. They include complete information pertaining to appurtenances and accessories.

2. They are submitted as a package where they pertain to related items.

3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.

4. They indicate the project name and address along with the Contractor's name, address and phone number.

5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

6. Equipment and materials requiring MEA approval (NYC) shall be submitted with the MEA number and with a reprint of the MEA approval.

D. Shop Drawing Review

1. The purpose of the review of shop drawings is to maintain integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.

2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

3. Substitutions of equipment, systems, materials, temperature controls must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change electrical requirements, or hanging or support weights or dimensions.

4. Any extra changes or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.

5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filed at the expense of the Contractor (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.

E. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.

2. As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.

3. Resubmit indicates that this item should be resubmitted for approval before further processing.

   a. If both "As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.

4. Not Accepted indicates that the item will not meet the intent of the Contract.

5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

1.6 SEPARATION OF WORK BETWEEN TRADES

A. The Specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the HVAC work.

B. In the absence of more detailed information, this list shall be taken as a specific instruction to the heating, ventilating and air conditioning trade to include the work assigned to it.

C. Indications that the heating, ventilating and air conditioning trade is to perform an item of work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

Oth = Other than electrical or mechanical

Plb = Plumbing

Htg = Heating, Ventilating & Air Conditioning

Elec = Electrical

f = Furnished

i = Installed

p = Provided (furnished and installed)

Item	Oth	Plb	Htg	Elec	Notes
Motors for Mechanical Equipment	___	___	p	___	
Motor Starters and Controls for Mechanical Equipment	___	___	f	i	
Power Wiring for Mechanical Equipment Motors	___	___	___	p	Specifications and drawings delineate detailed exceptions.
Undercutting of doors and door louvers	p	___	___	___	Supplying location where required included in mechanical.
Temporary Light & Power	p	___	___	___	
Hoisting	___	___	p	___	
Rigging	___	___	p	___	

Item	Oth	Plb	Htg	Elec	Notes
Cutting, Chasing & Patching	p				Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade.
Framed Slots and Openings in Walls Decks and Slabs	p				Coordination drawings are required from mechanical trade
Wiring for control of motors				p	
Sleeves Through Non-Membraned Slabs, Decks and Walls			p		
Drilling & Cutting of All Holes in Steel Decks and Precast Slabs Required for Sleeves & Supports			p		
Sleeves Through Membraned Slabs, Decks and Walls			p		
Waterproof Sealing of Sleeves Through Membraned Slabs, Decks and Walls			p		
Fireproof Sealing of Excess Openings in Slabs, Decks & Fire Rated Walls			p		
Wells or openings in piping for pressure, temperature, flow, etc.			p		Wells and fittings furnished by Temperature Control Subcontractor
Fastenings			p		
Supports			p		

Item	Oth	Plb	Htg	Elec	Notes
Concrete Foundations, Pads & Bases Inside Buildings	p				Furnishing of anchors and vibration mounts included in the mechanical trade
Field Touch-up Painting of Damaged Shop Coats			p		
Rustproofing Field Cut and Assembled Iron Supporting Frames and Racks			p		
Finish Painting of Exposed Work	p				Insulation coatings are by mechanical trade.
Exterior Wall Louvers	p				Duct connections & safing of all unused portions of louvers (2" thick insulated panel) is by Heating Trade.
Finished Wall and Ceiling Access Doors, Panels and Supporting Frames	p				Supplying list locating all required access doors (none to be less than 12" x 12") included in mechanical.
Vermiculite Fireproof Duct Covering	p				
Domestic Make-up Water Piping for Air Conditioning Systems		p			Final connections included in heating, ventilation and air conditioning.
Rubbish Removal			p		Where one trade furnishes and another installs, the installing trade removes the shipping and packing materials which accumulate.

Item	Oth	Plb	Htg	Elec	Notes
Special Tools for Equipment Maintenance	___	___	f	___	
Electric duct heaters (heaters installed in air ducts)	___	___	p	___	Line and control connections and control device mounting included in electric. Drawings delineate exceptions.
Electric Heater Cables for Radiant Space Heating	___	___	___	p	

E. The Heating, Ventilating and Air Conditioning Trade is required to supply all necessary supervision and coordination information to any other trades who are to supply work to accommodate the Heating, Ventilating and Air Conditioning installations.

F. Where the Heating, Ventilating and Air Conditioning trade is required to install items which it does not purchase, it shall include for such items:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.

3. Their safe handling and field storage up to the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected.

5. Their field assembly and internal connection as may be necessary for their proper operation.

6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.

7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

8. Items which are to be installed but not purchased as part of the work of the Heating, Ventilating and Air Conditioning trade shall be carefully examined by this trade upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of the Heating, Ventilating and Air Conditioning trade will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work of the Heating, Ventilating and Air Conditioning trade shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.7 RECORD DRAWINGS

A. As part of the required heating, ventilating, and air conditioning work, a complete set of "as-built" or record drawings shall be made up and delivered to the architect.

B. The drawings shall show:-

1. All heating, ventilating, and air conditioning work installed exactly in accordance with the original design.

2. All heating, ventilating, and air conditioning work installed as a modification or addition to the original design.

3. The dimensional information necessary to delineate the exact location of all ductwork and piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance. Where shop drawings have been prepared and approved, the "as-built" drawings shall be cross referenced to the respective shop drawing. In this case dimensions need not be shown on the "as-builts".

C. As-built record drawings shall include the updating of all equipment schedule sheets.

D. The record drawings shall be of a reproducible type as directed.

E. The design tracings will be made available for copying into reproducibles should it be determined that such reproducibles would serve as suitable backgrounds for the "as-built" drawings. The quantity of design tracings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.

F. This trade shall submit the "as-built" set for approval by the building department in a form acceptable to the department, when required by the jurisdiction.

1.8 TECHNICAL DEFINITIONS

A. Specific items of terminology, as used herein or on drawings, shall have the following meanings.

1. "Piping"----------Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids.

2. "Concealed"----------Embedded in masonry or other construction, installed behind wall furring, within double partitions or hung ceilings, in crawl spaces, in shafts.

3. "Exposed"----------Not concealed.

4. "By Other Trades" or "Others" or "Oth"-------By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall <u>not</u> be interpreted to mean not included in the overall contract.

B. Where reference is made to N.E.M.A. Standards, it shall be understood that this reference is to the "Approved Standards", published by the National Electrical Manufacturers Association, Main Office - 155 East 44th Street, New York, New York 10017.

C. Where reference is made to "A.S.A. Standards", it shall be understood that this reference is to the standards published by the American National Standards Institute Incorporated.

1.9 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS

A. As used in the drawings and specifications, certain non technical words shall be understood to have specific meanings as follows:

1. "Furnish"----------Purchase and deliver to the project site complete with every necessary appurtenance and support.

2. "Install"----------Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

3. "Provide"----------"Furnish" and "Install".

B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.

D. No exclusions from, or limitations, in the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

E. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations The work shall be installed, in accordance with the diagrammatic intent expressed on the electrical and mechanical drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

F. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

I. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

J. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by Bulletin is subject to the base building specifications in all respects.

1.10 CLEANING & PROTECTING

A. It shall be this trade's responsibility to store his materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.

B. The inlet and discharge openings of all terminal units shall be kept covered until all local plastering, parging, etc. is completed, and the units are ready to run.

C. Equipment and material if left in the open and damaged shall be repainted, or otherwise refurbished at the discretion of the owner. Equipment and material is subject to rejection and replacement if in the opinion of the engineer, or in the opinion of the manufacturer's engineering department, the equipment has deteriorated or been damaged to the extent that its immediate use is questionable, or that its normal life expectancy has been curtailed.

D. During the erection protect all ductwork, piping, and equipment from damage and dirt. Cap the open top of all ductwork and piping installed vertically.

E. After completion of project clean the exterior surface of equipment included in this section, including concrete residue.

F. Chemical Cleaning: All piping systems shall be thoroughly flushed out with the approved cleaning chemicals to remove pipe dope, slushing compounds, cutting oils, and other loose extraneous materials. This also includes any piping systems which are not listed as requiring water treatment. The cleaning chemicals shall be added by the mechanical trade. The chemical supplier shall instruct as to the proper feed rates, shall check that the cleaning solution is actually in each system, shall instruct the contractor as to when to flush the system and shall check each system following flushing to insure all cleaning chemicals have been removed from each system. The mechanical trade shall block open all modulating valves, zone valves and all other system restrictions. If building pumps are not available, this trade shall provide portable pumps to circulate water for cleaning purposes.

G. A certificate of cleaning shall be provided by the cleaning chemical supplier to the Architect's representative.

1.11 TESTING & BALANCING

A. It is the intent under this section of the work to obtain complete balancing of each and every fan, trunk ductwork, branch ductwork, pump and water system.

B. Note that VAV boxes are calibrated at factory. Nevertheless, recalibrate each VAV box in field as part of this work. Air balancer shall show two readings for each box, minimum and maximum.

C. Note that fan powered mixing boxes are calibrated at factory. However, due to changing inlet conditions, recalibrate each mixing box in field as part of this work and provide reading for box CFM, and primary air at maximum and minimum setting.

D. Miscellaneous Air Systems

1. First set of air filters shall be in place whenever fans are run. Replace with final set before testing.

2. Run supply fan with all dampers in their summer position (minimum outside air). Duplicate normal conditions as far as possible with clean filters in place, coils in operation, etc. Adjust for proper ratio of outside and return air.

3. All dampers shall be in the fully open position including dampers in mains, branches and in diffusers (splitter dampers to be in normal position).

4. Take readings of fan RPM, static pressure at inlet plenum of fan, static pressure at discharge of fan, ampere readings, cfm (by means of duct traverse). Traverse shall be made on 6" centers in a straight section of ductwork. Note that for backward curved fans use static pressure as check on cfm. For forward curved fans use ampere reading and RPM as check on cfm.

5. Readjust fan speed to obtain between 105% to 110% of specified cfm. This can be done by changing speed in direct proportion to change in desired cfm. Thus:

$$\text{New RPM} = \frac{\text{Desired CFM}}{\text{CFM by test}} \times \text{Original RPM}$$

6. Starting with branch dampers and air terminals furthest from fan readjust air terminals to desired cfm. Readings and test of diffusers, grilles, and registers shall include required RPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments. Verify all grille and diffuser "K" factors with manufacturer.

7. Readjust fan speed if necessary during balancing procedure. Note that where fans are specified to be variable pitch sheaves, these should be adjusted. Where fans are specified for fixed ratio sheaves replace with new sheaves at no extra cost to the Owner, until desired CFM is obtained. For fans specified with inlet vanes, use vanes to obtain required CFM. Dampers shall not be used to reduce air volume. Readjust ratio of outside air and return air.

8. Upon completion of all balancing obtain final readings noted above for presentation.

9. Instruments used for balancing must have been calibrated within 6 months prior to balancing. Types of instruments used and dates of calibration shall be listed on balancing report.

10. After completion of tests submit itemized list to Consulting Engineers of fan speeds in RPM, ampere readings, floor by floor and outlet by outlet air quantities in CFM, and static pressure at each floor and at each fan (suction and discharge) in inches of water gauge. For purposes of testing use pitot tubes with inclined manometer to traverse duct cross sections.

E. All Piping Systems

1. Water shall not be introduced into piping systems for testing without water treatment. All piping systems shall be tested to a hydrostatic pressure at least 1-1/2 times the maximum operating pressure (but not less than 40 lbs. per sq. in.) for a sufficiently long time to detect all leaks and defects. Where necessary, piping shall be tested in sections to permit the progress of the job.

F. Hydrostatic Testing Corrosion Inhibitor

1. If sections of system must be hydrostatically tested prior to cleanout, appropriate inhibitor shall be added to the test water at sufficient level to totally passivate metal and provide protective film on pipe surfaces to prevent corrosion prior to cleanout and treatment. Mechanical Contractor shall be responsible to coordinate this treatment with the water treatment contractor. At no time shall the Mechanical Contractor add water to a system without treatment.

G. Water Systems

1. Adjust balancing valves to obtain required flow and specified pressure drops across pumps, equipment, and coils.

2. Where venturi meters or calibrated orifices are specified test for GPM with portable or permanent type flow meters.

H. Testing of Automatic Controls

1. In cooperation with the control manufacturer's representative, adjust controls to operate as specified. Testing personnel shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.

I. Air Leakage Tests for Low and Medium Pressure

1. Before insulation is applied run fan at design static pressure and check all joints.

J. Notify landlord about the balancing. Copy of approved balancing report to be submitted to the landlord.

1.12 EQUIPMENT AND MATERIALS

A. All equipment furnished as part of the work shall comply with the latest editions of all applicable state and municipal "energy codes." Provide certification from the equipment suppliers for all energy-consuming equipment that the equipment fully complies with these codes. Equipment submissions will not be accepted for review unless accompanied by such certification in writing.

B. All equipment and materials shall be new and without blemish or defect.

C. New equipment and materials shall be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for, or where normally subject to such U.L. labeling and/or listing services.

D. Electrical equipment and materials shall be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be examined, tested and certified.. Where no specific indication as to the type or quality of materials or equipment is indicated, a first class standard article shall be furnished.

E. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction (such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

F. All equipment of one type (such as fans, pumps, coils, etc.), shall be the products of one Manufacturer.

G. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

H. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

I. Substitutions of Mechanical Equipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

1.13 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc will be provided by another trade.

B. This Trade is responsible for access door location, size and its accessibility to the valves or equipment being served.

C. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing Trade. Furnish and install distinctively colored buttons in finished ceiling.

D. Access doors shall be of ample size, minimum of 16" x 16".

1.14 OPERATING AND MAINTENANCE INSTRUCTIONS

A. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.

B. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:

1. Performance Curves: For pumps, and similar equipment at the operating conditions.

2. Lubrication Schedule: Indicating type and frequency of lubrication required.

3. List of Spares: Recommended for normal service requirements.

4. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.

5. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.

6. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.

7. Automatic Controls: Diagrams and functional descriptions.

C. Where applicable, one set of operating and maintenance instructions shall be neatly framed behind glass and hung adjacent to the equipment concerned.

D. Develop and submit to the user a procedure for the periodic testing of an emergency condenser water switch over and chemical treatment systems.

1.15 TOOLS

A. All special tools for proper operation and maintenance of the equipment provided under this specification shall be delivered to the Owner's representative and a receipt requested for same.

1.16 IDENTIFICATION

A. Valves

1. Attach a 2" round brass tag stamped with designating numbers 1" high filled in with black enamel to each valve, except those on fixtures.

2. Securely fasten valve tag to valve spindle or handle with a brass chain.

3. Provide approved ceiling tile markers in areas where removable ceilings occur to indicate location of valves or other devices.

B. Motor Control Identification

1. Mount black lamacoid nameplates on each motor controller identifying primary control function and individual position indication such as Pump No. 1, etc. Nameplates shall be cut through to white background and have beveled edges. Mount with chromium plated acorn head screws.

C. Schedules and Charts

1. Furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule shall indicate tag number, valve location by floor and nearest column number, valve size and service controlled.

D. Piping Identification and Coding

1. Apply color coded Polyvinyl Chloride pipe bands identifying pipe contents and direction of flow.

2. On exposed piping apply bands on 30 foot centers of straight runs, at valve locations, at points where piping enters and leaves a partition, wall, floor or ceiling.

3. On concealed piping installed above removable ceiling construction apply bands in manner described for exposed piping.

4. On concealed piping installed above non-removable ceiling construction, or in pipe shafts, apply bands at valve or other devices that are made accessible by means of access doors or panels.

5. Apply bands at exit and entrance points to each vessel, tank or piece of equipment.

6. Band widths shall be 8" for pipes up to 10 inch diameter. Letter heights stating service shall be preprinted on band 3/4" high for 8 inch bands.

7. For insulated pipes apply bands after insulation and painting work has been completed.

8. Colors shall conform to ASA Standard A13.1. Provide 24 additional bands of each type for future use by Owner's personnel. .

9. Follow manufacturer's instructions for application procedures using non-combustible materials and contact adhesives.

1.17 ELECTRICAL MOTORS, MOTOR CONTROLS, AND WIRING

A. For all work required in conjunction with electrical motors, motor controls, and wiring, see complete delineation on the drawings. Note that all motors, & starters are purchased by the HVAC Trade. Motors for equipment shall be provided by the Equipment Manufacturer. All equipment shall have U.L. label where obtainable.

B. See "Automatic Controls" for separation of work for control wiring between Electrical and HVAC trades.

1.18 CONNECTIONS TO EXISTING WORK (and alterations)

A. Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing facilities. Submit to the Owner for approval, date schedule of necessary temporary shut-downs of existing services. All shutdowns shall be made at such times as will not interfere with regular operation of existing facilities and only after written approval of Owner. To insure continuous operation, make necessary temporary connections between new and existing work. All costs resulting from temporary shut-downs shall be borne by this Contractor.

B. Connect new work to existing work in neat and approved manner. Restore existing work disturbed to original condition, or improve as specified herein or on drawings.

C. Alterations

1. Provide alteration work for piping, ducts and equipment as shown on drawings or described herein. If asbestos insulation is present or suspected to be present inform the Owner in writing so that such removal can be carried out by qualified personnel hired by the Owner. Do not commence demolition until such work has been completed.

1.19 MISCELLANEOUS FIRE PROTECTION & SEALING

A. In addition to fire protection means specified elsewhere in this specification, this trade shall comply with the following.

B. All spaces between ducts or pipes and their respective sleeves shall be packed full depth with rope, mineral wool, or other equally fire resistant material, and compressed firmly in place. Fiberglass shall not be used. Sleeve clearances shall not exceed 1/2 inch between pipes (or ducts) and sleeves. Use individual sleeves for each pipe or duct. Use escutcheons on both sides of sleeves. This includes spaces between ducts on pipes and their respective sleeves or openings at fan rooms (whether walls are fire rated or not).

1.20 FIRE AND SMOKE DETECTION

A. Fire and smoke detection system will be provided and installed by the Electrical trade. The HVAC trade will provide suitable openings (as recommended by the Smoke Detection System Manufacturer) in sheet metal for sensing elements.

B. This Trade will provide access doors to make all such detection heads accessible.

C. This trade will provide bracing for smoke detection sampling tubes which exceed 48" in length.

1.21 TESTING OF FIRE SAFETY SYSTEMS

A. This trade shall include in the base bid price sufficient man hours to conduct tests of fire safety systems. The trades shall jointly assign personnel to test the following

1. Electric

2. HVAC Fans and Dampers

3. Automatic Controls and Signals

4. Fire Suppression System (Sprinkler, Standpipe, Halon, etc.)

5. Fire Protective Alarm System

B. This trade shall coordinate with other trades and jointly test all systems. When all systems are working properly, inform Owner in writing so that Owner's representative can witness.

1.22 VERIFYING EXISTING CONDITIONS, REMOVALS AND ALTERNATES

A. Upon review of the contract drawings, and prior to submission of a bid proposal, the contractor shall inform the architect and/or engineer in writing of any discrepancies or request clarification if necessary concerning the intent of the plans and specifications to provide a complete working installation. Later claims by the contractor for extra labor, equipment or materials will not be recognized.

C. The contractor shall visit the premises to examine carefully the areas affected by this work and to become familiar with the existing conditions and with any difficulties that may attend the execution of this work. The contractor shall perform this prior to submission of his bid proposal. Submission of his bid proposal will be construed as evidence that such examination has been made and later claims will not be recognized for extra labor, equipment or materials required due to difficulties encountered which could have been foreseen had such an examination been made.

1.23 REMOVALS AND ALTERATIONS

A. The contractor shall remove, relocate, replace, adjust, adapt and modify existing equipment and/or systems as required by the drawings or specifications and as may be required when such work is uncovered and found to interfere with the completion of work in this contract or other contract work.

END OF SECTION

SECTION 15110 - PIPING SYSTEMS

1.1 PIPING SYSTEMS - GENERAL

A. The drawings indicate schematically the size and location of piping. Piping shall be set up and down and offset to meet field conditions and coordination between trades without additional cost. Piping shall conform to the latest revisions of ANSI/ASME B31.9 - "Building Services Piping."

B. Hydrostatic Testing Corrosion Inhibitor

C. If sections of system must be hydrostatically tested prior to cleanout, appropriate inhibitor shall be added to the test water at sufficient level to totally passivate metal and provide protective film on pipe surfaces to prevent corrosion prior to cleanout and treatment. Mechanical Contractor shall be responsible to coordinate this treatment with the water treatment contractor. At no time shall the Mechanical Contractor add water to a system without treatment.

D. Pipework shall conform fully to the following requirements:

1. Provide proper provision for expansion and contraction in all portions of pipework, to prevent undue strains on piping or apparatus connected therewith. Provide double swings at riser transfers and other offsets wherever possible, to take up expansion. Arrange riser branches to take up motion of riser.

2. Approved bolted, gasketed, flanges (screwed or welded) shall be installed at all apparatus and appurtenances, and wherever else required to permit easy connection and disconnection. Screwed unions with steel faces can be used on piping 1" or less.

3. All piping connections to equipment shall be made with offsets provided with screwed or welded bolted flanges so arranged that the equipment can be serviced or removed without dismantling the piping.

4. If, after system is in operation, any apparatus are stratified or air bound (by vacuum or pressure), they shall be repiped with new approved and necessary fittings, air vents, or vacuum breakers at no extra cost. If connections are concealed in furring, floors, or ceilings, this trade shall bear all expenses of tearing up and refinishing construction and finish, leaving same in as good condition as before it was disturbed.

D. Miscellaneous drains, vents and reliefs are to be provided as follows:

1. Miscellaneous drains, vents, reliefs, and overflows from tanks, equipment, piping relief valves, pumps, etc., shall be run to the nearest open sight drain or roof drain. Provide drain valves whenever required for complete drainage of piping, including the system side of all pumps.

2. Provide domestic water connections from valved outlets to any equipment requiring same.

3. Contractor shall cap or plug in all systems, all open ended valves for future connections, drains and vents. Also, in order to prevent a dead leg of water and consequent corrosion, provide a 1" open bypass from supply to return with balancing valve in all open condenser water systems.

E. Screwed piping shall conform to the following:

1. Pipe nipples - Any piece of pipe 3" in length and less shall be considered a nipple. All nipples with unthreaded portion 1-1/2" and less shall be extra heavy. Only shoulder nipples shall be used. No close nipples will be provided.

2. Screw threads shall be cut clean and true; screw joints made tight without caulking. No caulking will be permitted. A non-hardening lubricant will be permitted. No bushings shall be used. Reductions, otherwise causing objectionable water or air pockets, to be made with eccentric reducers or eccentric fittings. All pipe shall be reamed out after cutting to remove all burrs.

1.2 MATERIALS FOR PIPE

A. Pipe shall be fabricated from the following.

Closed Condenser Water	16" & below - Standard Weight Steel
Drain Pan Piping	Standard Weight Galvanized Steel
Hot Water Heating	Standard Weight Steel
Fresh Water	Type L Copper

NOTES

1. Unless specified otherwise, all steel piping shall be Type ASTM-A-53 ERW Grade B or seamless Grade B. Furnace butt welded pipe shall not be used. All pipe shall be of domestic manufacture, delivered to the job properly primed and marked and supplied with the interior surfaces clean and rust free. Each end shall be capped to avoid the rusting of the interior surface. Piping found to be in violation of this specification may be required to be removed from the job site whether or not already installed. Mill certifications from the pipe supplier shall be made available upon request.

B. All brass pipe shall be seamless drawn semi-annealed pipe containing not less than 85% copper as made by American Brass Company, Revere Copper and Brass, Inc., or other approved manufacturer and shall conform to ATSM B-43.

C. Galvanized steel pipe shall be hot dipped galvanized of Republic Steel Corporation, National Tube Co., Youngstown, or other approved manufacturer.

D. All copper tubing shall be not less than 99.9 per cent pure copper, as manufactured by Revere Copper and Brass Co., Chase Brass and Copper Co., Inc., Bridgeport Brass Co., or other approved. Wherever possible, tubing shall be continuous with couplings up to 20 ft. in length. Tubing shall conform to ASTM B88.

E. Piping specifications shall be submitted as required with shop drawings.

1.3 MATERIAL FOR FITTINGS

A. Fittings shall conform to the following:

B. Note that table defines the pipe size above which it becomes mandatory to fabricate by means of welding. Where table indicates screwed fittings, Contractor may elect to use welding fittings. Pressures shown are SWP (Steam Working Pressure).

Closed Condenser Water	3" & larger - standard weight welding end fittings. 2-1/2" & smaller - 250 lbs. cast iron screwed.

Drip pan piping	125 lbs. galvanized cast iron screwed.
Fresh water	Standard weight copper sweat fittings.

C. All welding elbows shall be long radius elbows as manufactured by Tube Turn, ANSI B16.9.

D. Where welding is used, fittings shall be Tube Turn, Bonney Forge, Taylor Forge, Ladish, or other approved manufacture, ANSI B-16.9. Welding end fittings shall have the same bursting pressure as pipe of the same size and schedule. Tee fittings shall be one piece except that weldolets are permitted where branches are at least one pipe size less than the main.

E. All cast iron fittings shall be Stockham, Grinnell, or other approved.

F. Fittings for connecting copper tubing to steel pipe shall be dielectric unions, non-reducing type. Pipe ends shall be female iron pipe thread to copper solder joint. Insulating gasket shall be so designed that it does not restrict the flow through the union fitting. Fittings shall be as manufactured by EPCO, Clearflow or Watts.

G. Fittings for copper tubing shall be Chase Sweat Fittings, Mueller Brass Co.'s "Streamline" solder fittings, or "Arco" wrought-copper fittings. "T"-Drill type fittings are not acceptable. All piping shall be installed in a workmanlike manner, according to the manufacturer's instruction. All joints shall be thoroughly cleaned before connecting. All solder for copper tubing shall have a melting point of not less than 460 degrees F., composed of 95% tin and 5% antimony, or brazing filler metal melting at or above 1000°F (silver or copper-phosphorus) in accordance with the following table. Regardless of pressures in table below, use 95-5 tin antimony for fresh water. Use brazing filler for piping 2" and over if copper is specified for open condenser water system.

SAFE STRENGTH OF SOLDERED JOINTS
Pressure Ratings

Solder used in Joints	Service Temperatures Deg.F	Maximum Service Pressure, PSI Water 1/4 to 1 inch Incl.	1-1/4 to 2 inches Incl.	2-1/2 to 4 inches Incl.
95-5 Tin-Antimony	100	500	400	300
	150	400	350	275
	200	300	250	200
	250	200	175	150
Brazing Filler Metal* melting at or above 1000°F	250	300	210	170
	350	270	190	155

* For service temperatures 200° and below, the rated internal pressure is equal to that of tube being joined.

1.4 VALVES

A. Furnish and install valves shown on the drawings, specified herein and/or necessary for the control and easy maintenance of all piping and equipment. All valves shall be first quality of approved manufacture, shall have proper clearances, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed ANSI working pressure cast on the body and cast or stamped on the bonnet, or shall be provided with other means of easy identification. All valves of one type (gate, ball, butterfly) shall be the product of one manufacturer for that type of valve.

B. Valves shall be of minimum working pressure and materials as fittings specified for the service except as herein modified. All gate and globe valves shall be suitable for repacking under pressure. Regardless of service, valves shall not be designed for less than 125 pounds per square inch steam working pressure.

C. The following chart designates valve categories for shut-off valves:

CATEGORY	SIZE	MFG TYPE	AS ST'D	FIG.NO.RATING
V-3	2" & DN Ball 600# W.P.@ 100°F	Jenkins	901-AE (SCRD)	(400# W.P. @ 200°F)
	2½ & UP Butterfly	Keystone	362-104 Lug Type	150# ANSI (Max.Work Press.260# @ 200°F)
V-4	2" & DN Ball 600# @ 100°F	Jenkins	901 AE (SCRD)	(400# W.P. @ 200°F)
	2½ & UP Butterfly	Keystone	372-104 Lug Type	300# ANSI (Max.Work Press.675# @ 200°F)

NOTES

1. Powell equivalent figure numbers:

   Shut-Off Valves

		Jenkins	Powell
V-1	2" & DN	228OU	375
	2½ & UP	204C	1797
V-2	2" & DN	47CU	2700
	2½ & UP	651-C	1793
V-3	2" & DN	901-AE	4210T
V-4	2" & DN	901-AE	4210T

2. Valves smaller than 8" shall have multi-position latching handle.

3. All ball valves shall have balancing stop plate Jenkins Fig. 901-TE.

D. Following chart designates valve pressure designations:

SERVICE	VALVE CATEGORY
Condenser water	V-4
Hot water heating	V-3

E. Butterfly valves shall be high performance lug type, Keystone, Jamesbury, McCannalok, or approved equal.

1. The face-to-face dimensions must meet API 609 MSS SP 67.

2. Pressure vessel is to meet full ANSI ratings.

3. Valve is to seal bi-directionally at full ANSI ratings. Valves shall hold full pressure with one flanged connection removed.

4. Valves are to be able to take full rated differential pressure when dead ended.

5. The valve must have locating lugs on the body to position the valve between ANSI flanges to prevent the disc hitting inside of Schedule 40 pipe.

6. All valves should be designed to ANSI B16.5 and B16.34.

7. All valves to be functionally tested, to include cycling the valve and topworks, measuring seating torque and verifying leaktight performance of the seat.

8. The valve should be capable of thermal cycling over its complete pressure/temperature range.

9. The shaft packing must be capable of sealing at 1.5 times the pressure vessel rating.

10. The valve should be designed to convert from handle operation to automated valve operation without removing the valve from the pipeline.

11. There must be external indication of the disc position.

12. Valve stem packing area shall be fully accessible for adjustment without removal of operator.

13. If manually operated, the valve must have a positively retained shaft in case there is a failure of the shaft to disc attachment.

14. Self-lubricated bearings should be used. There will be a method of retention to prevent bearing movement.

15. No loose parts should be used to attach the shaft to the disc. Two or more pins should be used for complete attachment.

16. A double offset shaft should be used to reduce seating torque.

17. Valves body material shall be carbon steel. Shafts shall be 17-4 PH stainless steel. Discs shall be 316 stainless steel. Stem seals shall be TFE. Seats shall be self-energizing TFE or self-energizing TFE totally encapsulating an elastomeric "O" ring. Metal springs or components shall not be used to and in seat sealing.

18. Valves shall be selected as follows:

	Max. Working Pressure at	Max. Working Pressure at	Model #			
Cat.	ANSI	100°F	200°F	Rockwell Jamesbury	McCannalok	Keystone
V-3	150 #ANSI	285#	260#	815L-11-22HBMT	L151-CS-T-S6	362-104
V-4	300 #ANSI	740#	675#	830L-11-22HBMT	L301-CS-T-S6	372-104

NOTE
1. Valves 6" and smaller shall have multi-position latching handle.

F. Lubricated plug valves at pump discharges shall be Rockwell Manufacturing Co., or approved, as follows.

CAT	SIZE	MFG	FIGURE NO.	RATING
V-3	Up to 3"	Rockwell Operated	143 Wrench (165# @ 200°F)	175# CWP
	4" & over	Rockwell Gear	169 Worm (190# @ 200°F)	200# CWP
V-4	Below 6"	Rockwell Operated	305 Wrench (370# @ 200°F)	400# CWP
	6" & over	Rockwell Gear	1489 Worm (370# @ 200°F)	400# CWP

NOTES

1) All valves to be flanged except below 2"

2) Lubricated tapered plug.

3) Sealed port lubrication system.

4) Teflon coated plug.

5) Fixed gland adjustment when valve rating is 200 lb. WOG or higher to suit actual operating pressures.

6) Equipped with adjustable stops.

7) Factory lubricated.

G. Check valves other than multiport check valves at pumps shall be Jenkins, Powell or approved equal. Bronze screwed for 2" and down with regrinding bronze disc and iron body above 2" with regrind - renew bronze disc, and seat ring with bolted cover. Pressure ratings equal or greater than ratings of shutoff valves scheduled.

CAT	SIZE	MFG	FIGURE NO..	RATING	RATING @ 200°F NON-SHOCK
V-3	2" & DN	Jenkins	4092 (SCRD)	150# SWP	
	2" to 12"	Jenkins	629C (FLGD)	125# SWP	190#
V-4	2" & DN	Jenkins	4962 (SCRD)	300# SWP	560#
	2½" to 6"	Jenkins	339C (FLGD)	250# SWP	460#

NOTES

1. Powell equivalent figure numbers

   Check valves

		Jenkins	Powell
V-3	2" & DN	4092	578
	2" to 12"	629C	578
V-4	2" & DN	4962	560Y
	2½ to 6"	339C	576

H. Multiport check valves at pump discharge shall be semi-steel installed at pump discharge as follows:

CAT.	SIZE	MFG	FIGURE NO.	RATING
V-3	Up to 12"	Mueller	101 AP Wafer	125# ANSI (175 @ 100°F)
V-4	Up to 12"	Mueller	107 AP Globe Type	250# ANSI (400# @ 100°F)

I. Balancing Valves

1. Balancing valves shall be ball type for 2" and down, lubricated plug valves for above 2", and shall be full line size. At cooling towers use butterfly valves.

J. Miscellaneous Notes

1. Furnish valve tags as described elsewhere.

2. Globe valves be of equivalent pressure ratings and manufacturer to that stated for gate valves.

3. Chilled water piping connections to air conditioning units shall include all necessary gate valves, air vent valves, drain connections and automatic valves.

4. Compression type, key operated air cocks shall be furnished and installed where required for additional venting. Cocks shall be 1/4" in size and shall be all bronze construction, at least two dozen keys shall be delivered to the Owner's representative for operating these cocks.

1.5 STRAINERS

A. There shall be approved strainers in the inlet connections to each make-up connection, each water regulating valve, each pump, each vent, and each diaphragm valve. The intention is to protect by strainers, all apparatus of an automatic character whose proper functioning would be interfered with by dirt on that seat, or by scoring of the seat. Strainers shall be Sarco or approved.

B. All strainers in waterlines (including all pump inlets) shall be Y-pattern, set in a horizontal (or vertical downward) run of the pipe. Where this is not feasible strainers may be of enlarged-cross-section type. Strainers shall be so arranged as not to "trap" pipes, and to facilitate disconnection and opening-up for cleaning. Unless otherwise indicated, strainers shall be line size.

C. All strainers shall have cast iron, semi-steel or bronze bodies equivalent to ratings specified in "valves" subjected, removable cylindrical or conical screens of monel or stainless steel and suitable flanges or tappings to connect with the piping they serve. They shall be of such a design as to allow blowing out of accumulated dirt, and to facilitate removal and replacement of a strainer screen, without disconnections of the main piping.

D. Strainer screen perforations shall be 1/16" perforations for sizes up to 3"; 1/8" perforations for sizes 4" to 12".

E. Provide approved valved and capped dirt blow off connections for each strainer 1-1/2" and larger, with the valve located 6" to 0" below strainer or as directed.

F. Nipples and valves to be full size of strainer blow off tapping. Strainers 1¼" and smaller to have capped nipples at least 6" long. For all strainers, the blow out connection is to terminate in an approved manner, at a point where there will be no risk of flooding or damage.

G. All strainers shall be provided with flanged covers for screen removal in lieu of screwed covers for screen removal wherever obtainable.

1.6 **WELDING PROCEDURE**

A. Pipe welding shall comply with the provisions of the latest revision of ANSI/ASME B31.9 Building Services Piping, or such state or local requirements as may supersede codes mentioned above.

B. Before any new pipe welding is performed, submit a copy of welding Procedure Specifications together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction.

C. Before any operator shall perform any pipe welding, submit the operator's Qualification Record in conformance with provisions of the code having jurisdiction, showing that the operator was tested under the proven Procedure Specification submitted.

D. Repair or replace any work not in accordance with these specifications.

1.7 HANGERS, SUPPORTS

A. Pipe supports shall be of the following type and figure number as manufactured by C & P, F & M, Grinnell, or as approved. Figure numbers of hangers or supports not shown shall be subject to approval.

PIPE HANGER SCHEDULE

	C&P	F&M	Grinnell
Beam Clamp	268	282	---
Clevis Hanger	100	239	260
Clevis Roller Hanger	140	272	181
Insert	266	---	280
Continuous Slotted Insert	1480	190	---

B. Maximum spacing between pipe supports, for steel pipe to prevent excessive stress: This does not apply where there are concentrated loads between supports.

Pipe Size	Max. Span/Ft.	Pipe Size	Max. Span/Ft.
1/2"	5	4"	14
3/4"	6	5"	16
1"	7	6"	17
1-1/2"	9	8"	19
2"	10	10"	22
2-1/2"	11	12" & Over	23
3"	12		

C. Maximum weights on hanger rods assuming a maximum operating temperature of 450°F shall be such that stress in tension shall not exceed 9000 psi, using root area of threaded portion. In no case shall hanger size be less than 3/8" for pipe up to 2", 1/2" for pipe 2-1/2" to 3-1/2", 5/8" for pipe 4" to 5", 3/4" for pipe 6", 7/8" for pipe 8" to 12".

D. For copper tubing, supports shall follow schedule and specifications. Supports for uncovered lines shall be especially designed for copper tubing, and shall be of exact O.D. diameter of tubing and shall be copper plated.

E. Roller type supports shall be used for pipes subject to axial movement. They shall be braced so that movement occurs in roller rather than support rods.

F. Provide shields at hangers for cold insulated piping and saddles welded to pipe at hangers for hot insulated piping.

G. Provide all steel required for support of pipes and equipment other than steel shown on structural engineer's drawings. Submit calculations of anchor design.

H. All hangers on piping including clevis hangers, rods, inserts, clamps, stanchions, brackets, shall be dipped in Zinc Chromate Primer before installation.

I. All pipe supports shall be designed to avoid interferences with other piping, hangers, electrical conduits and supports, building structures and equipment.

J. Pipe hangers shall be connected to building structure as follows:

Building Structure Type	Pipe Support Method
Building Structure Steel	Beam Attachments, etc.
Metal Deck Floor Slabs w/ Concrete Fill	Galvanized steel inserts, fishplates of sufficient area to support twice the calculated dead load, approved type specialty hanger accessories manufactured for the specific purpose of attaching to metal deck floors.

1.8 SLEEVES AND ESCUTCHEONS FOR PIPING

A. General

1. Provide sleeves for each pipe passing through walls, partitions, floors and roofs.

B. Sleeve Materials

Type Designation	Sleeve Material
1	#18 gauge, galvanized steel.
2	Standard weight galvanized steel pipe.
3	Standard weight galvanized steel pipe with a continuously welded water stop of 1/4" steel plate extending from outside of sleeve a minimum of 2" all around - similar to F & S Mfg. Corp. Fig. 204.
4	Cast iron pipe sleeve with center flange - similar to James B. Clow & Sons No. F-1430 and F-1435.
5	Standard weight galvanized steel pipe with flashing clamp device welded to pipe sleeve or watertight sleeves - similar to Zurn 195-10 with oakum and lead caulking as required.
6	Metal deck and wall sleeves similar to Adjust-To-Crete Mfg. Co.

C. Sleeve Sizes

1. Floors and required fire rated partitions - 1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

2. Partitions not fire rated - 1-1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

D. Sleeve Lengths

Location	Sleeve Length
Floors	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.
Roofs	Equal to depth of roof construction including insulation.
Walls & Partitions	Equal to depth of construction and terminated flush with surfaces.

E. Sleeve Caulking & Packing.

Type Designation Caulking & Packing Requirements	
A	Space between pipe and sleeve packed with oakum or hemp and caulked watertight with lead.
B	Space between pipe or pipe covering and sleeve shall be caulked with an incombustible, permanently plastic, waterproof non-staining compound leaving a finished smooth appearance or pack with mineral wool or other equally approved fire resistive material to within 1/2" of both wall faces and provide caulking compound as per above.

F. Sleeve Application

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation
5	5	Membrane waterproof floor, roof and wall construction	B Note: Another trade will carry membrane up around sleeve and down inside sleeve
5	5	Non membrane waterproof floor, roof and wall construction where flashing is required	A or B
2	1,2,	Interior walls, partitions and floors	B
3 or 4	3 or 4	Exterior walls	A
2	6	Metal deck floors	B
1	1	Precast concrete floor with poured concrete topping. Note: Sleeves to have flat flanges and/or guides which rest on top of precast slab	B

G. *Escutcheons*

1. Provide escutcheons on all exposed piping passing through walls, floors, partitions and ceilings, except provide close fitting metal escutcheons on both sides of piping (whether exposed or not) through required fire rated walls, floors, partitions & ceilings.

2. Escutcheons shall be held in place by internal spring tension or set screws.

H. Application

Location	Escutcheon Material
Finished Spaces	Anodized aluminum, chrome plated brass.
Unfinished Spaces: Excluding mechanical equipment rooms	Plain brass, cast iron or aluminum.

1.9 CENTRIFUGAL PUMPS

A. Pumps shall be of manufacturer as shown on drawings, or approved equal.

B. Submission for approval must show brake horsepower, KW input, and full load efficiency. Pump curves shall indicate such operation.

C. The design impeller diameter shall be selected so that the design capacity of each pump (GPM and TDH) shall not exceed 90% of the capacity obtainable with maximum impeller diameter at the design speed for that model.

D. In all cases, motor sizes shall be selected to be completely non-overloading over the entire performance range of the particular pump involved, for the installed impeller size.

E. Water Temperature: Pump to comply with specific application.

F. Mounting: As described under "Vibration Isolation".

G. Alignment: Final alignment to be done after piping is completed, before start-up, by manufacturer's representative. Alignment shall be made with dial indicator to a tolerance of ±.022".

H. Guarantee: Pump to deliver required gpm against design head within ±3% without over-heating motor, bearings or any other parts and without producing noise audible outside the space in which the pumps are installed. Certified test statements to be provided for each pumping unit. Seals to be replaced without charge if faulty operation or unusual wear occurs during guarantee period, not caused by maintenance faults.

1.10 WATER TREATMENT AND CHEMICAL CLEANING (WATER SYSTEMS)

A. Hydrostatic Testing Corrosion Inhibitor

1. If sections of system must be hydrostatically tested prior to cleanout, appropriate inhibitor shall be added to the test water at sufficient level to totally passivate metal and provide protective film on pipe surfaces to prevent corrosion prior to cleanout and treatment. Mechanical Contractor shall be responsible to coordinate this treatment with the water treatment contractor. At no time shall the Mechanical Contractor add water to a system without treatment.

B. Provide a water treatment system for the open side of liquid cooler and for tenant's supplementary close type condenser water system.

C. Water treatment company shall develop maintenance program for periodic circulation of primary -spray water, scheduled bleed-off and make-up to prevent legionella pneumophila bacteria growth.

D. Water treatment contractor shall be building vendor-Drew Water Service Co.

1.11 THERMOMETERS AND PRESSURE TEST CONNECTIONS

A. Provide as shown on the drawings.

1.12 INSTALLATION OF APPURTENANCES AND SENSORS IN PIPING

A. Provide all fittings, wells and openings required for installation of devices to indicate flow, temperature, pressure, etc., in piping systems.

END OF SECTION

SECTION 15120 - AIR DISTRIBUTION SYSTEMS

1.1 SHEET METAL DUCTWORK

A. General

1. All ductwork; flues, register boxes, air chambers, dampers, and all auxiliary work of any kind, necessary to make the various air conditioning, ventilating and heating systems of the building complete and ready for operation, shall be furnished and installed.

2. The specifications refer to SMACNA standards, which shall be considered minimal. If local codes require other standards than described in SMACNA, local codes shall govern.

3. All ductwork indicated on drawings is schematic. Therefore, changes in duct size and/or location shall be made where necessary to conform to space conditions, without additional cost to the Owner.

4. Ductwork and sheet metal plenums connected to intake or discharge louvers shall be galvanized steel, painted for the first 10 feet with bitumastic, pitched to a low point, and provided with a 1-1/2" copper drain piped by this trade to a building drain. See detail for construction.

5. Intake and discharge plenums at the louvers serving liquid cooler and discharge plenum at the emergency generators shall be built of the double wall 4" thick acoustical type panels constructed of quality spangled galvanized steel, phosphatized steel, or bonderized steel. Units shall be constructed with a 18 gauge galvanized outer sheet and a 22 gauge galvanized and perforated inner sheet. Perforations shall be 1/8" diameter round holes on 5/16" staggered centers. Inner lines at sides of cooling coils shall be 22" gauge solid galvanized. Galvanized meta shall not be painted; phosphatized or bonderized metal shall be finished with rust-inhibiting paint. Joints between panels shall contain acoustical fill and shall be covered with 18 gauge galvanized stripping inside and out, sealed leakage. Seams shall be caulked with silicone type sealant. Internal and perimeter reinforcement channels shall be spot welded and riveted in place forming a completely metal encased acoustic unit.

Spot welds shall be maximum 3" o.c. and shall be ground and painted. Walk-in access door to be provided at each plenum. Bottom at the plenums shall not have internal perforated liner but shall be reinforced with minimum 16gauge sheet metal to walk-on.

6. Dimensions given on drawings of all acoustically lined ducts shall be the clear inside dimension. Refer to "Acoustical Treatment".

7. A snap lock seam shall not be permitted as a substitute for the Pittsburgh lock except for systems with pressure classification +1" and less and where longitudinal joints are sealed and riveted at corners.

8. Where the trade elects to use "Duct-Mate" for joints or similar product, PVC clips are not permitted (use metal) and all corners shall be bolted (boltless connectors are not permitted) except where local codes permit Duct-Mate joints as breakaway connection at fire dampers. Only gaskets manufactured by Duct-Mate are acceptable.

9. Use gasketed type joint when dissimilar metals are joined.

10. Sealant shall be "Hardcast Iron Grip" water duct sealant 601, United Sheet Metal's United Duct Sealer or approved equal (submit for approval).

11. All ductwork unless otherwise noted shall be hung with 1 in. x 1/8 in. galvanized iron bands. Ductwork with cross sectional area under 4 square feet shall be hung on 8'-0 in. centers. For ducts with a cross-sectional area of more than 4 sq. ft. but not over 10 sq. ft. hangers shall be no more than 6 feet apart, and for ducts with a cross sectional area of more than 10 sq. ft. hangers shall be no more than 4 ft. apart. All hangers shall be bent (2" minimum) under the bottom as well as the sides and secured with sheet metal screws.

12. Where ducts are stacked they shall be independently supported as above or shall be supported on minimum 1¼" x 1¼" x 1/8" angle cradle hung by either 1¼" x 1¼" x 1/8" angles or 3/8" diameter threaded rod.

13. All ductwork shall be substantially built with approved joints and seams smooth on the inside and a neat finish on the outside. Duct joints as near air tight as possible, with laps made in the direction of air flow and no flanges projecting into the air stream. Ducts shall be adequately braced to prevent vibration. All angles shall be galvanized or shop painted with two coats of rust resistant paint.

14. Changes in shape and dimension shall conform to the following:

    a. For increases in cross-sectional area, the shape of the transformation shall not exceed 1" in 7".

    b. For reductions in area the slope may be 1" in 4" but 1" in 7" is preferred.

15. Changes in direction shall conform to the following:

    a. Unvaned elbow with throat radius not less than 1/2 the width of the duct.

    b. Square elbows with double thickness duct turns shall be as per SMACNA with 2-1/8" spacing, and are acceptable in ducts with not more than 2200 FPM air velocity. For higher velocities, use sweep type vanes.

16. Wherever it may be necessary to make provisions for vertical hangers of the ceiling construction passing through ducts, provide streamlined shaped sleeves around such ceiling construction hangers as to fully protect the duct from being punched with holes for the passage of such hangers. Any such streamlined sleeves shall be made air tight at top and bottom of ducts. In no case shall there be more than two rods in any 9 sq. ft. area. No rods shall pierce ducts smaller than 12" in horizontal area. No hangers shall pierce high pressure ducts.

17. Furnish and install manual dampers, fire dampers, fire/smoke dampers,registers, grilles, register boxes, access doors, sound traps, etc., as described elsewhere in the specifications and as required for a complete system, ready for operation.

18. Exact dimensions of register boxes must await approval of grilles, and exact locations shall be submitted for approval, otherwise any changes directed after installation shall be made without additional cost. All register boxes and other opening of the ductwork must be kept tightly closed during construction to keep out rubbish.

19. Access doors as specified elsewhere shall be provided in the ducts wherever required for access to fusible link dampers or other controls.

B. Provide No. 16 USSG, 3/4" wire mesh screen over each open return duct in hung ceiling unless register or grille is shown.

C. Duct systems shall be galvanized steel and shall comply with the pressure classifications following in compliance with Page 1-17 to Page 1-22 inclusive of SMACNA HVAC Duct Construction Standards, first edition, 1985. Duct sealants shall have a U.L. label and shall have a flame spread rating not over 25, and a smoke developed rating no higher than 50 when in the final dry state.

Duct System	SMACNA Table No.	SMACNA Pressure Classification	SMACNA Seal Classificatior
All supply ducts on systems with VAV terminal boxes from fan discharge to box	1-6	+3" W.G.	A
All supply ducts on systems without VAV terminal boxes from fan discharge to diffuser, and all ductwork downstream of VAV boxes to diffusers	1-5	+2 W.G.	B
All return ducts and exhaust ducts, where not used for smoke exhaust	1-4	-1" W.G.	B
All return ducts and exhaust ducts if used for smoke exhaust	1-6	-3" W.G.	A

D. Flexible Air Duct

1. Flexible air ducts shall be all metal construction consisting of bonded two-ply laminate mechanically corrugated for strength and airtightness. Flexible air ducts shall be semi-rigid construction capable of being easily hand pre-formed into required elbows or offsets to suit job conditions without subsequent sagging or droop. Duct connections to equipment outlet collars shall be made in accordance with the duct manufacturer's recommendations. Flexible duct shall be Flexmaster Type V as manufactured by Flexmaster U.S.A. Corporation or approved equal.

2. Material shall have been tested by Underwriters Laboratories Inc. and given the listing 181 Class I duct material, and comply with NFPA 90A.

3. Connections shall be clamped with Ideal Type 52 hose clamps.

4. Length of flexible duct shall be as shown on the drawings but shall not exceed length dictated by local jurisdiction.

5. Cut duct to proper length to avoid sharp bends.

E. Mechanical Contractor shall submit all fan room sheet metal ductwork shop drawings to the AC unit manufacturer prior to submission to engineer for review. AC unit manufacturer shall approve the air performance and acoustical performance of the AC units in the location and with the ductwork configuration and construction as shown on the shop drawings. AC unit manufacturer shall indicate approval directly on the ductwork shop drawing.

1.2 DAMPERS FOR BALANCING

A. Provide manual dampers for balancing the air systems.

B. Construction shall conform to latest SMACNA standards. When installing dampers in ducts to be insulated provide raised bracket for damper quadrant with height equal to insulation thickness.

C. If location of balancing dampers is not defined on the drawings the following minimum standards shall govern:

1. All supply & return air main branches from trunk, and all sub branches from mains shall have balancing dampers.

2. Locate damper as far as possible from air outlet to avoid noise transmission.

3. Provide and/or coordinate with G.C. for easy access to damper, or otherwise furnish remote damper actuator same as Young Regulator Models 914, 927 or approved equal.

1.3 ACCESS DOORS IN SHEET METAL WORK

A. This Contractor shall provide suitable access doors and frames to permit inspections, operation and maintenance of all valves, all coils including reheat coils, controls, fire dampers, air monitors where applicable, automatic or motorized dampers, filters, bearings, traps, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter. Doors in insulated ducts or insulated casings shall have rigid fiberglass insulation between the metal panels.

B. All access doors in sheet metal ducts shall be hung on heavy flat hinges and shall be secured in the closed position by means of cast zinc clinching type latches. Where space conditions preclude hinges, use four heavy window type latches. Doors into ducts shall in general not be smaller than 18" x 18" except for access door to fire dampers which will depend on size of fire damper. Submit samples for approval.

C. In no case shall access to any items of equipment requiring inspections, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device.

1.4 DAMPERS FOR FIRE PROTECTION

A. Dampers and doors for fire protection shall be identified by the use of the symbol FLD on the drawings. Note that the use of the symbol FLD implies the provision of access doors. For installation in 1-1/2 Hr. or 2 Hr. fire separations or fire divisions provide 1-1/2 hour fusible link fire dampers U.L. labelled for use in Class B openings. For installation in 3 or 4 hour fire separations or fire divisions provide two fire dampers in series U.L. labelled for use in Class A openings, or other UL classified damper rated for 3 hrs.

B. Fusible Link Dampers (FLD)

1. Fusible Link Dampers and Fire Doors shall be installed where shown in the drawings and where required by code, and shall be of the folding blade type, Fire/Seal as manufactured by Air Balance, Inc., and shall bear the Underwriters' Laboratory label. Type "A" mountings shall be used for velocities up to 3000 feet per minute, type "B" mountings for velocities to 4500 feet per minute and whenever ducts are 10" or less in height (regardless of the air velocity inside the duct), and type "C" mountings for velocities over 4500 feet per minute. Velocities are defined as net velocity through free area of damper. Horizontally mounted dampers shall be operated by stainless steel negotiator springs with locking devices to insure positive closure. Fire damper shall meet the requirements of latest N.F.P.A. Bulletin #90A, and shall be tested in accordance with U.L. 555 test criteria for fire, corrosion and dust loading, labelled and listed by Underwriters' Laboratories. Dampers of other manufacturers may be approved subject to proper submission of Underwriters acceptance plus pressure drop calculations.

2. Local codes shall take precedence where they supercede NFPA. However, the Contractor shall notify the Engineer in writing citing such differences by reference to such codes should the contract documents not reflect these differences.

3. FLD's shall be provided as follows:

   a. At each penetration of a vertical shaft. On upflow exhaust ducts where permitted by Code, a 22" long internal boot may be used after approval of duct pressure drop calculation.

   b. At each fireproof slab penetration where there is no vertical fireproof shaft.

   c. At each penetration of a required fire separation or fire division.

   d. At each penetration of a required fire rated corridor or ceiling.

C. General

1. Units should be Board of Standards & Appeals Approved type for use in New York City.

2. The Contractor shall clearly indicate location of units on shop drawings and shall provide access doors in the ducts at each damper of sufficient size and type to permit inspection and replacement of linkage. Provide itemized list of fire dampers for inspection and for posting in Engineers office. It shall be the Contractor's responsibility to coordinate all locations of duct access doors.

3. Access doors shall be cam latched with vinyl gasket to provide tightest possible seal between the duct and frame. Doors shall be self-tightening and gasketed with hand operated cam locks and will be fully insulated. Access doors shall be Air Balance, Inc. Fire/Seal or approved equal.

4. Comply with U.L. recommendations for break away connections at maximum distance of 6" from wall, and all other U.L. recommendations and local code requirements. Retaining angles must be wide enough to have sufficient bearing on wall (minimum surface contact of 1").

1.5 FLEXIBLE CONNECTIONS

A. All fan and air supply unit connections, both at inlet and discharge shall be made with flexible material so as to prohibit the transfer of vibration from fans to ductwork connecting thereto, without air leakage. The material between the clamps shall have sufficient slack so as to prevent tearing due to fan movement.

B. The flexible connections shall be a minimum of 12" long and held in place with heavy metal bands, securely attached, to prevent any leakage at the connection points.

C. Flexible connections shall be fabricated from approved flame proofed fabric conforming to 90A of the N.F.P.A. Asbestos cloth is not permitted.

1.6 AIR INTAKES AND DISCHARGES

A. Air intake and discharge louvres and screens in the facade of the building shall be furnished and installed under another contract.

1.7 AIR DISTRIBUTION DEVICES

A. Grilles, Registers and Diffusers

1. Contractor shall furnish and install where shown on the drawings all diffusers, grilles and registers of the sizes, types and capacities indicated.

2. Diffusers shall be aluminum or steel and shall be factory finished with baked enamel finish of colors selected by Architect.

3. Submit shop drawings indicating throw, terminal velocity, noise criteria (NC), sound power, static pressure and total pressure of each type and size of air outlet.

4. Supply air units shall distribute the specified quantity of air evenly throughout the occupied zone uniformly, draftlessly and noiselessly. Sound levels shall not exceed ratings as required in the "Acoustical Treatment" Section of these specifications.

5. For devices installed in plaster construction, supply plaster frames as required for setting. All design and margin construction shall be coordinated with architectural requirements. Plaster frames where required shall be constructed of same material and finish as air terminal.

B. Ceiling Diffusers

1. All ceiling diffusers shall be furnished and installed with an equalizing deflector and volume damper. If diffuser is to be used for return air, omit equalizing deflector. Supply diffusers shall be gasketed to prevent streakage. Blank-off or sectorizing baffles shall be furnished as indicated. Diffuser frames and margins shall be compatible with ceiling construction Diffusers shall be aluminum or steel and shall be factory finished with baked enamel finish of color selected by Architect.

2. Diffusers shall be round, square, rectangular or linear as indicated on drawings.

C. Grilles and Registers

1. Supply air registers shall be of the double deflection type with key operated opposed blade damper.

2. Supply air grilles shall be identical to above with omission of opposed blade volume damper.

3. Return and Exhaust Air Registers shall be of the fixed bar type, with blades set at either 0° or 45°, and shall be furnished with key operated opposed blade damper. Return or exhaust grille shall be identical to above with omission of opposed blade damper.

1.8 SINGLE DUCT VARIABLE AIR VOLUME UNITS (PNEUMATIC)

A. Variable air volume units shall be furnished and installed as indicated on the drawings and shall have the capacity as indicated on the schedule.

B. Manufacturer, sizes, capacities, and performance are as indicated on drawing schedules. Units as manufactured by other manufacturers shall be considered as equal, if they meet performance specifications. Any substituted product shall, in all aspects, conform to the engineered sound and pressure drops specified.

C. Variable air volume units shall be low-pressure terminals of sizes and capacities shown in the schedule and on drawings. All units shall be capable of shutoff features without additional control components or piping.

D. Terminals shall be pressure independent and shall reset air volume within ±5% of required air flow, as determined by the space thermostat, regardless of changes in system air pressure. Devices using cfm limiters will not be acceptable. The terminal air valve shall be normally open on loss of pneumatic pressure, unless otherwise specified. The minimum setting shall be 20% of peak flow.

E. The internal resistance of the terminal shall not exceed 0.4 inch w.g. for all sizes when handling maximum air volume shown on schedules. Air flow measuring sensor shall be provided in the inlet of the unit. The sensor shall be of the averaging type which will provide a differential pressure signal and shall scan the air flow over not less than 4 quadrants of the inlet and shall be center tapped. Accuracy shall be maintained within ±3% regardless of the inlet duct configuration from straight to 90° elbow. Capped differential pressure taps shall be provided within the control enclosure for air measurement with a 0-2 inch gauge. Each terminal shall have a flow chart attached. Field adjustment of maximum and minimum primary air volume shall be accomplished with simple adjustment screws.

F. Discharge sound shall be as indicated in the terminal unit schedule on the plans with ducts acoustically lined as indicated in the schedule or shown on the plans. Radiated sound ratings shall be submitted and indicated without credit for ceiling construction attenuation.

G. The casing shall be of double shell construction meeting SMACNA or ASHRAE standards with sandwiched "foamed in place" insulation, meeting the requirements of NFPA Bulletins 90A and 90B.

H. Terminals shall be complete with factory-furnished and installed actuators, and accessory controls suitable for a 20 psi pneumatic control system. They shall be mounted in an easily accessible enclosure, and completely piped, requiring only a main and room thermostat connection. The room thermostat and main air and branch connections to the terminals shall be under the "Automatic Temperature Control" Section.

I. The acoustical performance of the variable volume units shall be tested in accordance with ADC Test Code 1062R4 standards, in an ADC, or independent approved laboratory. The manufacturer shall submit guaranteed sound power levels by octave bands. The sound power level shall be based on 10-13 watts. The octave band analysis shall be shown for .75", 1-1/2" & 3" S.P. Differential across the terminal unit. Neither the manufacturer nor the specific unit selection will be approved until such ratings have been submitted. The sound power level data submitted shall substantiate that the equipment types and sizes operating, as in an installed condition per plans and specifications, shall conform with data scheduled.

J. Prior to the approval of variable air volume boxes, the manufacturer shall demonstrate to the owner and/or his representatives, the operation of a typical unit. This demonstration shall be conducted over the full operational range. If the unit so demonstrated is acceptable, the manufacturer shall make and submit an octave band analysis of this unit over the full operational range in an acoustical laboratory reverberant chamber. All similar production units shall have acoustical characteristics within plus or minus 2 db of the unit demonstrated, when operated under the same design conditions in the same test facility.

K. The manufacturer shall submit the following information determined in a reverberant chamber subsequent to the demonstration of the unit in the typical space for both discharge and radiated sound:

1. Sound power data by octave bands.

2. A description of the technique and apparatus used to determine sound power.

3. The test chamber room constants by octave bands.

4. The technique and apparatus used to determine the room constant.

5. Complete operating conditions at the time of testing, including room temperature, air temperature, static pressures, etc.

1.9 CENTRIFUGAL FANS

A. General: Fan performance shall be based on tests conducted in accordance with AMCA Standard Test Code for Centrifugal and Axial Fans and fans shall bear the AMCA Certified Ratings seal. Unit shall be of manufacture as noted on drawings, or approved. Submit sound power ratings for approval.

B. Conditions for Approval

1. Submission for approval must show brake horsepower, KW input and full load efficiency.

2. Any corrective measures shall be the responsibility of Fan Manufacturer at no cost to Owner.

C. Housing: Braced to prevent vibration or pulsation. Inlet to be fully streamlined.

D. Wheel and Blades: Wheels shall be statically and dynamically balanced before shipment. For construction use high strength alloy steel, treated for corrosion resistance (spark resistance, if required) or aluminum.

E. Finish: Interior and exterior of fan to be factory coated; manufacturer's standard rust resistant paint acceptable.

F. Vibration Isolation: Vibration isolators shall be provided as specified elsewhere.

G. In cases of fans where more than one speed is specified isolators shall be selected for the lowest speed.

H. The motor and fan base shall be welded or bolted to form a common base to prevent any uncommon physical motion of the fan and motor.

I. Electric Motors: Each fan shall be provided with an electrical motor and motor control as specified elsewhere.

J. Submit certified fan performance curves.

1.10 PANS AND DRAINS OVER ELECTRICAL EQUIPMENT

A. This contractor shall provide pans under all equipment and piping subject to leaks where calls for on the drawing. Each pan shall be properly pitched with a drain outlet provided and piped to a floor drain or suitable waste.

1.11 FAN POWERED TERMINAL DEVICES (ELECTRIC HEAT) (PNEUMATIC ACTUATOR)

A. Furnish and install variable volume fan-powered terminal devices as indicated on the Drawings. The devices shall have duct connections with sizes as indicated on the Drawings. The devices shall be provided with a primary variable air volume damper that controls the primary air quantity in response to a pneumatic controller. The devices shall contain a fan and motor assembly, and factory mounted electric heating coil at the discharge of the fan with factory installed coil controls. Where scheduled and/or indicated on the Drawings. The fan shall provide a constant volume of discharge air at all air blending ratios from minimum to maximum scheduled primary air quantities and zero to 100 percent return air flow rates and shall be controlled in sequence as outlined hereinafter. The space limitations shall be reviewed carefully to ensure all boxes will fit in the space allowed including National Electric Code clearances required in front of all panels containing electrical devices. Provide multiple doors to service all internal components and a removable panel to service the fan and electric motor. Removable access panels shall be of sufficient size to allow removal of the fan and motor assembly as a unit. The access doors on all boxes may have screw or recessed quick opening cam latches. If purchased for temporary heat, provide a filter rack with a 1" thick throwaway filter to be used during construction. Filter shall be removed by the Mechanical Contractor after construction period and prior to air balancing.

The device shall include all equipment and controls to provide an operating system with at least the following equipment and controls:

1. Single point electrical connection for 277 volt, single phase, 60 hertz electrical power. See Electrical Drawings for power feeder arrangements and location of connection point for each device.

2. Factory mounted circuit breaker or fuse disconnect switch sized to protect all device electrical components.

3. Individual electrical protection devices as required to protect individual devices and transformers as required for individual component voltages other than 277 volt.

4. Provide a manual fan speed control system which shall allow continuously adjustable fan speed from a maximum to minimum as shown on the manufacturer's fan curves. For boxes serving perimeter zones, provide a second speed controller set for reduced fan speed for winter operation. Speed controller shall incorporate a minimum voltage stop to insure motor cannot operate below 55% of its rated voltage. Submit motor voltage and RPM values for minimum fan curves for each model. Manufacturer may submit units with motor voltage operation below 55% of rated voltage if accompanied by certification of motor manufacturer that operation at submitted voltage does not diminish motor life. The fan speed control system will be furnished by box manufacturer to modulate the fan speed.

5. Provide a multi-point flow sensor device that will limit the maximum primary cfm to the terminal unit to that indicated on the Drawings. A multi-point flow sensor shall be located in the primary duct connection and at each return air inlet. The primary inlet shall be equipped with a gradual transition (SMACNA Construction Standards) as required to connect to the primary duct size shown on the Drawings. The transitions shall be provided and installed by the box manufacturer. The transition shall provide at least a 4" length with a 3/8" high raised bead approximately 1-1/2" from the inlet connection. Provide a separate flow sensor in each return air to or the discharge air from the box for air balancing of the terminal unit. If two return air flow sensors are required for the design of the terminal unit they shall be piped together to a single set of ports located within or on the unit. The primary and fan design cfm settings shall be clearly and permanently marked on the bottom of the unit along with the box identification numbers. Provide a transformer with 24 volt AC secondary to provide power for the box controls. The multipoint flow sensors shall be capable of controlling the terminal unit discharge air volume (CFM) to within five (5) percent of scheduled design fan air volume (CFM). A test shall be conducted in an independent testing laboratory acceptable to the Engineer and Owner to prove compatibility of the flow control system and the fan powered terminal device at various primary flow rates from 250 fpm to 1500 fpm and the accuracy of the discharge air volume (CFM). The test may be witnessed by the Engineer and Owner. Test results shall be submitted to the Engineer and Owner for review.

6. Fan motor assembly shall be a forward curved centrifugal fan with a direct drive motor. Motors shall be similar and approved equal to General Electric Energy Saver specifically designed for use with a speed control device and voltage input to unit as low as 145 volts. Motors shall incorporate lo-loss electromagnetic steel with both rotor and stator annealed for minimum eddy current losses. Stators shall have the necessary copper content (slot - fill), and rotors open aluminum bars to insure stability and minimum generated noise at a reduced voltage input of 55% of rated value. Provide isolation between fan motor assembly and unit casing to eliminate any vibration from unit casing. Provide anti-back rotation system or provide a motor that is designed to overcome reverse rotation and not offset life expectancy. Motor wiring shall incorporate a UL listed plenum rated quick disconnect electrical coupling for ease of fan removal.

7. Electric heaters shall be of capacity as shown on the drawings.

   Heating coil to be integral to the unit, not an add on. Units with heaters shall be UL listed for zero clearance shall bear the UL listing mark and label. Each heater shall meet all requirements of the National Electrical Code.

   Each heater terminal box and frame shall be constructed of heavy gauge corrosion resistant metal. Heating elements shall be constructed of Type A 80-20 nickel-chromium wire and shall not glow when operating at the rating quantities.

   Heaters shall be provided with factory supplied and pre-wired branch circuit fusing as required by NEC and UL circuiting and fusing shall also be in accordance with the circuit requirements as shown on the plans.

   Provide 460 volt, 3 pole - 15 amp fused disconnect switch mounted on unit.

   Each heater shall be complete with:

   a. Contactors.

   b. Primary thermal cut-off to de-energize the heater in case of overheating.

   c. Differential air pressure switch to de-energize heater and stop the fan.

d. Pneumatic electric switches as required for staging the electric heaters and night cycling of the fan.

Heater voltage and stages shall be as follows:

Up to 4.0 KW - 460 V/3 phase, 2 steps

Over 4.0 KW - 460 V/3 phase, 3 steps

8. The primary air damper shall be of a design that shall vary primary air supply in response to an electronic signal. Damper leakage at shutoff shall not exceed 4% at 1.5" w.g. system static pressure. Submit damper leakage test data to the Engineer for review. Damper operation shall be demonstrated to be closed before the hot water heating coil is allowed to operate. No overlap under any conditions will be allowed. Damper shall be located inside the unit. Damper connection to the operating shaft shall be a positive mechanical connection to prevent any slippage. Motor operator shall have sufficient torque to operate damper smoothly through its full range with close off within specified leakage. Manufacturer shall submit a life cycle test report on damper and motor assembly from a certified independent laboratory of a minimum of 10,000 cycles from full open to full close without failure of any part of motor or damper. Provide non-lubricated delrin, nylon, teflon or mylar bearings for the damper shaft. The primary air damper in conjunction with the flow control sensors shall be selected to provide control at low primary air velocities. The total deviation in primary air flow shall not exceed ± 5% of the primary air cfm corresponding to a 250 fpm air velocity through the primary air valve at 1" w.c. inlet static or alternate low flow control logic to offset low flow deviation, subject to Engineer's approval. The primary air flow fidelity shall be laboratory demonstrated and proven with any inlet configuration and inlet static variation from 0.2 to 2.0 inches w.g.

9. A mixing chamber to provide mixing of primary air and fan air from 100% primary air to 0% primary air, with a temperature variation four feet downstream of the device as specified hereinafter.

10. Duct and inlet connections as indicated on the Drawings. The terminal unit casing shall be capable of round or rectangular primary inlet connections without casing obstruction of airflow into damper assembly. Provide primary inlet gradual duct transitions constructed in accordance with SMACNA Standards as required. The inlet duct connection for round ductwork shall be at least 3" long with raised retaining bead approximately 1-1/2" from inlet connection.

11. Sound attenuation of air stream noise and acoustical treatment of box to comply with the following with 1" W.G. inlet pressure and 0.30" W.G. discharge pressure, and the specified design air volume scheduled on the Drawings. Radiated noise readings shall be recorded at 0.5" W.G., 1.0" W.G., 1.5" W.G. and 2.0" W.G. inlet static pressures and a discharge static pressure of .30 inches. w.g.

    a. Limit the terminal unit radiated noise as follows. All occupied tenant spaces and and public areas shall be equal to or less than NC 35 when installed above the ceiling material specified in another Division of the Specifications. Every size unit at the scheduled design conditions shall be sound laboratory tested prior to bid date for this project in a mockup of a typical 15' x 15' tenant office. The laboratory mockup test shall use the specified ceiling light fixture, Project ceiling height, Project ceiling plenum depth, and typical ductwork. The terminal units shall be mounted directly above the lighting fixtures at the height indicated on the Drawings. The test will be conducted in accordance with test procedures approved by the Engineer and the acoustical consultant to demonstrate compliance with the NC acoustical criteria within the tenant space. If the VAV fan-powered terminal unit manufacturer has conducted the hereinbefore specified acoustical mockup test and compatibility test with the DDC controller, and with this project's typical conditions, and has demonstrated to the Engineer and general contractor compliance with the specified acoustical performance and compatibility, the previous testing will be accepted and will not need to be repeated. Mockup tests will be witnessed by the Engineer and general contractor and the acoustical consultant.

12. Treatment to limit the noise to an amount that will not produce more than a sound level as specified above when installed in the duct system as indicated on the Drawings. The rectangular ductwork system downstream of the terminal devices is lined with 1/2" thick, 2 lb. density duct for the lengths as specified on drawings or herein.

13. Unit maximum radiated sound power levels as published by the manufacturer with 1-1/2 inches w.g. inlet pressure and the specified design air flow scheduled on the drawings shall be as follows:

Octave Band Mid Frequency Hz	Maximum PWL (DB RE: 10-12 Watts)
125	70
250	63
500	60
1000	57
2000	57
4000	57

14. The entire assembly shall be enclosed in a galvanized or aluminum sheet metal single or double wall housing of sufficient rigidity so that it does not vibrate due to action of the turbulent air on the panels of enclosing metal. This requires minimum 20 gauge sheet metal and stiffeners. Double wall terminal units shall have a 20 gauge galvanized outer sheet and a 22 gauge perforated galvanized inner sheet over a structural steel frame. The entire casing assembly upstream of the primary air valve shall be capable of withstanding a maximum static pressure of 3.0" W.G. All casing joints upstream of the primary air damper or valve shall be sealed with approved adhesive to meet the maximum leakage rate specified herein.

15. Thermal and acoustical insulation for all portions of the device in contact with primary cold or fan-powered heated air shall be double density acoustical insulation. The insulation shall have a maximum thermal conductance of 0.24 Btu per inch per hour per square foot per °F at 75°F. The fire-resistant coating shall bind the surface fibers tightly to prevent any fibers from becoming loose. The insulation, facing and adhesive shall have a composite fire and smoke hazard rating as tested by procedure ASTM E84, NPA 225, and UL 723 not exceeding: Flame Spread 25, Smoke Developed 50. Adhesives, mastics and cements shall have the same component ratings listed above. Any cut edge exposed to the moving air stream shall be coated with mastic.

16. Mounting connections for hanging the device by sheet metal straps shall be clearly identified on the housing. All components, including all controls, and all wiring shall be factory installed. No field assembly will be allowed. The device shall be complete to accept the following field adjustments:

    a. Primary duct.

    b. Secondary duct.

    c. 277 volt, single phase, 60 hertz electrical connection.

    d. Provide sufficient P.E. controls to allow central pneumatic primary air to discreetly control the following functions.

        1) All boxes, air on-fan starts. Air off-fan stops.

    e. Room pneumatic thermostat connection to modulate primary damper and heating staging.

B. The primary system is designed to provide at least 0.2" W.G. at the inlet to the terminal device. All downstream static pressure requirements are to be supplied by the FPT fan.

C. The control sequence shall be as follows from full cooling to full heating:

    1. Primary damper open to allow scheduled maximum primary air quantity and close to minimum primary air quantity.

    2. Fan shall operate continuously when the primary air system is in operation as activated by pneumatic air being sent to boxes and when the space temperature drops below 55°F.

    3. The fan shall operate continuously for the cooling and heating cycle.

    4. Factory installed electric heating coil shall be energized in stages to match the heating requirement.

D. Each size of each device to be used on this Project shall be completely laboratory tested for air performance and acoustics. The acceptability of any other laboratory and testing facilities is subject to review by the Owner and the Engineer. The device manufacturer shall submit complete details, brochures, instrumentation information, etc., for review. The laboratory shall be capable of properly testing the largest device on this Project. The air volume listed on the Drawings for this device shall be supplied for the test with the cold duct supplying 48°F air and the bypass space supplying 80°F air. At primary air damper or valve positions as indicated hereinafter and with an inlet static pressure of 0.50" W.G. and 1.0" W.G. the mixing device shall be capable of producing a mixed air stream of which the temperature shall not vary more than 1.0°F over the duct 48" downstream of box for each 12°F difference between the temperatures of the entering warm and cold air. The variation of temperature shall be proportionally less at smaller temperature differences. There shall be at least fifteen temperature readings made at the discharge outlet duct over the entire discharge area with the air entering the device in each of the following proportions:

1. 25% cold air and 75% hot air.

2. 50% cold air and 50% hot air.

3. 75% cold air and 25% hot air.

Operating of the flow control device shall be demonstrated to repeat under all conditions of operation of the primary air damper or valve and duct pressures as specified hereinbefore. If the VAV fan-powered terminal unit manufacturer has conducted the hereinbefore specified air performance and air mixing tests and has demonstrated to the Engineer and general contractor compliance with the specified criteria the previous testing will be accepted and will not need to be repeated. The engineer and general contractor reserve the right to retest a production terminal at the terminal unit manufacturers cost upon two weeks written notice. The engineer or general contractor shall select the terminal unit of their choice.

E. After the manufacturer has submitted six certified copies of the laboratory test results to the Engineer, the Engineer may witness the laboratory tests to verify compliance with the Specifications.

F. All fan powered boxes shall be identified on the bottom of the unit and on the shipping carton with the floor and box number that identifies it along with the CFM settings.

G. Each fan powered terminal shall be tested at the factory before shipment. Testing shall include at least the following:

1. Operational Test:

   a. Drive the primary air damper or valve in the cold air inlet closed.

   b. Connect a known pneumatic pressure signal to simulate air flow through the primary air damper or valve.

   c. Connect the flow sensor HI and LOW ports to an electronic manometer or controller.

   d. Apply electric power to the unit.

   e. Start the fan. Verify fan rotates properly.

   f. The primary air damper or valve should drive closed. Closure will be verified by feel or visual observation.

   g. Verify all stages of heating (P.E. settings) and change in fan speed for perimeter boxes.

2. Construction Inspection:

   a. Sealant applied to seams upstream of the primary damper.

   b. Bolts and rivets secure.

   c. Liner firmly attached.

H. The VAV fan powered terminal devices shall not contain asbestos and shall be so certified to the Engineer.

I. These Specifications set forth the minimum requirements for VAV fan powered terminal devices. If it complies with these Specifications, VAV fan powered terminal devices manufactured by one of the following manufacturers will be acceptable: Titus-QFPC, Trane, or Envirotech.

END OF SECTION

SECTION 15130 - INSULATION

1.1 GENERAL INSULATION REQUIREMENTS

A. Insulation shall be applied on clean dry surfaces, after inspection and release for insulation application.

B. Insulation shall be continuous through wall and ceiling openings and sleeves. Where insulated piping or ductwork pierces fire rated partitions, walls, and floors, substitute anhydrous calcium silicate insulation with vapor barrier in lieu of fiberglass for a minimum of 8" from wall, to produce a hard surface for fire resistive packing.

C. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold services shall be adequately insulated and vapor sealed to prevent condensation.

D. Inserts shall be installed at hangers for cold insulated piping. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Inserts shall have sufficient compressive strength so that when used in combination with a sheet metal shield, they support the weight of the pipe and the fluid in it without crushing the insulation.

E. Insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E.84, NFPA 255 or UL 723 not exceeding:

Flame Spread	25
Smoke Developed	50

Accessories such as adhesives, mastics, cements, and tapes for fittings shall have the same component rating as listed above. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facings to impart flame and smoke-safety shall be permanent. The use of watersoluble treatments is prohibited.

F. The only exception to the above material requirements is where a material meeting these requirements is not available from any manufacturer, in which case substitute items shall be subject to individual approval.

G. Where insulation is specified for piping, insulate similarly all connections, vents, drains, and any piping connected to system subject to heat loss or gain.

H. Adhesives and coatings shall be as manufactured by Benjamin Foster or approved equal as follows:

	Benjamin-Foster
Vapor Barrier Adhesive	82-07
Vapor Barrier Coating	30-35
Lagging Adhesive	30-36
Insulation Adhesive	85-20
Glass Cloth Adhesive	85-20
Weatherproofing Mastic	GPM

I. Asbestos shall not be used in the manufacture of insulation products.

1.2 INSULATION FOR PIPING

A. Piping systems described shall be insulated as follows, including all flanges, fittings, valves, expansion joints, vents, drains and all other parts of the system. All piping subject to freezing such as in outdoor air or discharge plenums or outdoors shall be insulated with a minimum of 2" insulation.

Piping System	Insulation Thickness	Insulation Type
Drains from A.C. Units, cooling coil drip pans, & miscellaneous piping subject to sweating	1/2"	P-2
Condenser water piping	1"	P-1
Hot water supply and return over heat tracing	2"	P-3

B. Type P-1 Glass Fiber for Cold Pipes

1. Insulation shall be glass fiber with a maximum K factor of .24 at 75 degrees F mean temperature with factory applied all-service jacket.

2. Jacket laps and butt straps shall be adhered neatly in place with Benjamin Foster 85-20 or approved equal. End of pipe insulation shall be sealed off with BF 30-35 at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs of pipe.

3. Concealed fittings and valves shall be insulated with minimum one-pound density FSK-faced fiberglass blanket wrapped firmly under compression (minimum 2-1) and secured with 18 gage copper-clad wire. Exposed edges of insulation shall be sealed off with BF 30-35. Finished thickness of insulation on fittings and valves shall be at least as great as that on adjoining pipes.

4. Exposed fittings and valves and all flanges shall be insulated with molded fitting covers or fabricated segments of pipe insulation. Flange insulation shall extend a minimum of 1" beyond the end of the bolts, and the bolt area shall be filled with Mineral Wool Cement. Insulation on exposed fittings and valves and all flanges shall be vapor sealed by imbedding a layer of white open weave (20 x 20) glass fabric in a 1/16" thick coat of BF 30-35 and then applying a second coat in the same thickness after the first coat has dried.

C. Type P-2 Glass Fiber for Anti-Sweat Insulation

1. Same material and application techniques as for Type P-1.

D. Type P-3 Glass Fiber for Hot Pipes

1. Insulation shall be glass fiber with a maximum K factor of .24 at 75 degrees mean temperature and shall be furnished with a factory applied all-service jacket.

2. Jacket laps and butt straps on exposed pipe insulation shall be adhered neatly in place with Benjamin Foster 85-20 or approved equal. On concealed pipe insulation in lieu of lap seal adhesive jacket laps and butt straps may be secured with outward clinching staples positioned approximately 3" apart.

3. Insulation shall be capable of continuous service at a pipe temperature of 450°F without oxidation, burnout of binders, or development of odors or smoke.

4. Concealed fittings and valves shall be insulated with minimum one-pound density FSK-faced fiber glass blanket wrapped firmly under compression (minimum 2 - 1) and secured with 18 gage copper-clad wire.

5. Exposed fittings and valves and all flanges shall be insulated with molded fitting covers or fabricated segments of pipe insulation. Flange insulation shall extend a minimum of 1" beyond the end of the bolts, and the bolt area shall be filled with Mineral Wool Cement. Insulation on exposed fittings and valves and on all flanges shall be finished by ime=bedding a layer of white open weave (20 x 20) glass fabric in a 1/16" thick coat of BF-30-36 and then applying a second coat in the same thickness after the first coat has dried.

1.3 INSULATION FOR SHEET METAL

A. Note that ductwork and casings which are acoustically lined, as describerd elsewhere, need not be insulated on the exterior.

B. Insulate sheet metal as follows:

1. All air conditioned and/or heated low pressure supply ductwork on low pressure systems without devices which reduce air pressure from fan discharge to diffusers, grilles and registers - 1-1/2" Type D-1 for round ducts and concealed rectangular ducts - 1" Type D-2 for exposed rectangular ducts.

2. All return air ductwork in non-conditioned spaces shall be insulated similar to low pressure supply ductwork. Ceilings of conditioned spaces shall not require return ductwork insulation.

3. All medium pressure ductwork from fan discharge to any air terminal device which reduces air pressure -1-1/2" Type D-1 for round ducts and concealed rectangular. 1" Type D-2 for exposed rectangular ducts. All low pressure ductwork from air terminal device which reduces pressure to diffusers, grilles, and registers - 1-1/2" Type D-1.

4. Ducts and sheet metal plenums behind louvers containing all or a percentage of outside air on inlet side of air handling units and ventilation fans - two inch Type D-2.

5. Exhaust air ductwork from automatic dampers to discharge louvers (including sheet metal plenums behind louvers) - two inch type D-2.

6. Non air conditioned and non heated outside air supply - 2" type D-1 for concealed ducts, 2" type D-2 for exposed ducts.

C. Type D-1 Flexible Duct Insulation With Vapor Barrier

1. Flexible duct insulation shall be 1 lb per cu. ft. density glass fiber with a maximum K factor of 0.29 at 75 degrees F. mean temperature, with reinforced foil-faced, flame resistant kraft vapor barrier.

2. Insulation shall be secured with duct adhesive. All joints shall be sealed by adhering a 2" sealing lap at all joints with vapor barrier adhesive or 3" strips of vapor barrier jacket applied with vapor barrier adhesive. Insulation shall then be fastened with 16 gauge copperclad wire or fiberglass cord on 12" centers. On ducts over 24" wide, welded pins & clips shall be used on the underside.

3. Exposed round shall have a white vinyl reinforced foil vapor barrier. Application same except wires shall be omitted and blanket shall be secured by stapling 2" longitudinal lap. Staples shall be coated with vapor barrier coating.

D. Type D-2 Rigid Duct Insulation With Vapor Barrier

1. Rigid duct insulation shall be 4.2 lbs per cu. ft. density glass fiber with maximum K factor of .24 at 75 degrees F mean temperature with vapor barrier facing.

2. Insulation shall be impaled over welded pins applied to duct surface on 12" to 18" centers. Use a minimum of two rows of fasteners on each side of duct. Secure insulation with suitable speed washers or clips firmly imbedded into insulation.

3. All joints and voids in the insulation shall be filled with Mineral Wool Cement. All joints, speed washers and breaks in the vapor barrier shall be sealed with 3" wide strips of the vapor barrier facing adhered with vapor barrier adhesive.

4. Exposed duct work shall have a white reinforced foil vapor barrier facing. Care shall be taken in sealing joints speed washers, etc. with matching strips of vapor barrier to insure good appearance.

END OF SECTION

SECTION 15140 - ACOUSTICAL TREATMENT & VIBRATION ISOLATION

1.1 ACOUSTICAL TREATMENT

A. Duct lining shall be one of the following: Owens Corning Aeroflex, Manville Linacoustic, CertainTeed Ultralite 150 (substitutions are not acceptable).

B. Lining density shall be 1½ lb. per cubic foot, minimum thickness of 1", unless specified greater.

C. Approval of the above named products is contingent upon samples to be submitted to our office. Also, after approval, contractor shall furnish to the job site a section of the material applied to a 24 x 24 section of sheetmetal. This will be maintained at the job site for quality control.

D. This contractor shall make all necessary repairs to the lining where improperly applied, or damaged.

E. Duct sizes shown on drawings shall be considered as inside dimensions.

F. An inner metal liner consisting of 22 ga. galv. steel with 3/32" dia. holes on 3/16" or 1/4" centers or the equivalent aluminum shall be installed as follows. (Fastening for metal liners shall only be by welded stud. Where duct cross section exceeds 48" the top section shall be fastened with twice the amount of clips.)

1. Where shown on drawings.

2. Where called for elsewhere in these documents.

3. Where the duct can be walked on, metal liners shall be used on bottom portions.

4. Where the velocity in the duct exceeds 3500 FPM.

G. The leading edge of duct liner (facing into the air flow) of each non abutting section such as the first section facing into the fan, or the first section after a sound trap, or ducts having a velocity in excess of 3,500 FPM shall have a metal nosing.

H. Application: All portions of duct designated to receive duct liner shall be completely covered with duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black coated surface of the duct liner shall face the air stream. The duct liner shall be adhered to the sheet metal with 100% coverage of adhesive and all exposed leading edges and all transverse joints coated with adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for Adhesives for duct liner; ASC-C-7001C-1972. The duct liner shall be additionally secured with mechanical fasteners (Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association), except that gripnails or the equivalent shall not be allowed. Duct liner shall be cut to assure overlapped and compressed longitudinal corner joints. Fasteners shall start within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and shall be spaced as recommended by SMACNA.

1. The following items shall be acoustically lined. Where distances of lining are indicated, the intent is that all ductwork <u>in any direction</u> be acoustically lined.

   a. Rectangular ductwork downstream of terminal units a minimum distance of fifteen feet.

   b. All conditioned air rectangular supply ductwork within mechanical equipment room. If the distance from fan discharge to mechanical room wall is less than 25 feet continue acoustical lining to a distance of 25 feet from fan discharge. For medium pressure systems, add inner metal liner.

   c. Upstream of exhaust fans, a minimum distance of fifteen feet.

   d. Downstream from exhaust fans a minimum of fifteen feet if the discharge of the exhaust fan runs through occupied spaces.

   e. Where shown on drawings or as specified in drawing notes.

1.2 FOUNDATIONS AND VIBRATION ISOLATION

A. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports, all as specified herein, or as shown on the drawings.

B. All rigidly or resiliently installed equipment, piping, etc., shall be capable of accepting seismic forces of 0.50g acting in any direction on the equipment center of gravity without permanent displacement of the equipment from the installed position.

C. All concrete foundations and supports (and required reinforcing and forms) will be furnished and installed by another trade. However, this trade shall furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports, and all required hanger bolts and other appurtenances necessary for the proper installation of his equipment. Although another trade will complete all concrete work, all such work shall be shown in detail on the shop drawings, prepared by this trade which drawings shall be submitted showing the complete details of all foundations including necessary concrete and steel work, vibration isolation devices, etc.

D. All floor-mounted equipment shall be erected on 4" high concrete pads over the complete floor area of the equipment, unless specified to the contrary herein. Wherever hereinafter vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted upon 4" high concrete pads unless specified to the contrary herein. These pads shall be integrally keyed to structural slab.

E. The vibration isolation systems shall be guaranteed to have the deflection indicated on the schedule on the drawings. Mounting sizes shall be determined by the mounting manufacturer, and the sizes shall be installed in accordance with the manufacturer's instructions.

F. All mounting systems including seismic restraints exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) to be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.

G. Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the

loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load versus deflection curve and have 50% excess capacity without becoming coil bound.

H. Each seismic restraint, snubbing device or isolation mounting incorporating seismic restraint shall be installed and/or adjusted to provide the minimum operating clearance in all directions to permit the operation of the equipment without objectional noise or vibration to any part of the building structure.

I. Vibration isolation equipment submittal drawings shall include the following information:

1. Isolation mounting deflections.

2. Spring diameters, compressed spring heights at rated load; solid spring heights, where steel spring isolation mountings are used.

3. Equipment operating speed.

J. The following vibration control vendors will be approved provided mounting systems are in strict accordance with the design intent as specified herein.

Mason Industries, Inc., Hollis, New York
Vibration Eliminator Co., Long Island City, N.Y.
Vibration Mountings & Controls Inc., Butler, N.J.

1.3 MOUNTING OF CEILING SUPPORTED PACKAGED AIR HANDLING UNTIS, TUBULAR ARRANGEMENT 9 FANS AND BELTED VENT SETS - MOUNTING TYPE VII:

A. This equipment shall be mounted exactly as described for TYPE VI including seismic design except that mounting shall be one of the following, or as approved:

Type HD - M.I.I.
Type RHD - V.M.C.I.
Type CD - V.E.C.

B. Diagonal hanger rod isolators shall be provided as required to limit horizontal motion to 1/4 inch maximum under fan operating conditions.

1.4 MOUNTING OF CENTRIFUGAL PUMPS - (GREATER THAN 3 HP):

A. Each pump with its driving motor shall be bolted and grouted to a spring supported concrete inertia base reinforced as required.

B. Each concrete base (rectangular or "T" shape) for horizontally split pumps shall include supports and base elbows for the suction and discharge connections. Base elbows shall be bolted and grouted to the concrete foundation.

C. Concrete inertia base thickness shall be in accordance with the following schedule:

Motor Size	Minimum Inertia Block Thickness Required
5 HP to 20 HP	6"

D. The spring supported concrete inertia foundation shall be poured within structural perimeter frame (reinforced as necessary) of the required thickness indicated in the above schedule. The structural perimeter frame shall be equipped with height saving brackets, seismic restraints, and stable bare spring isolators having spring diameters no less than 0.8 of the compressed height of the spring at rated load. The mountings shall provide minimum static deflections as indicated on the equipment schedule. The structural perimeter frame, mounting templates, height saving brackets, seismic restraints, and spring system shall be provided as an assembly by the vibration control vendor.

E. Mounting assemblies shall be one of the following or as approved:

Type KSL - M.I.I.
Type AWPF - V.M.C.I.
Type SN-OSK - V.E.C.

1.5 MOUNTING OF CENTRIFUGAL PUMPS (3 HP OR LESS):

A. Pumps 3 HP or less shall be bolted and grouted to rubber-inshear supported reinforced concrete inertia blocks that are a minimum of 6 inches thick and incorporate seismic restraints. Rubber-in-shear isolators shall provide a minimum static deflection of 3/8 inch and shall be protected against corrosion. Mountings shall be as described for TYPE IV.

1.6 Support of Piping

A. The following water piping shall be resiliently supported:

1. All piping in equipment room.

2. Piping outside of equipment room within 50 feet of connected rotating equipment.

3. All other piping shall be rigidly supported and provided with approved seismic restraints to maintain the piping in a captive attitude without excessive motion. All piping seismic restraints shall be installed with a maximum spacing conforming to the hanger rod spacing schedule as hereinbefore specified or as required to limit transmitted forces to the building structure to acceptable limits.

B. Resilient diagonal mountings or other approved devices shall be provided as required to limit piping motion due to equipment startup or shut down, to a maximum of 1/8 inch.

C. Water piping hanger rod isolators shall contain a steel spring in series with a 1/4 inch acoustical neoprene pad within a steel box retainer. The hanger rod isolator assembly shall be rigidly supported from the building structure. The installed hanger rod supported from the spring sub assembly shall not contact the steel box retainer and clearances in the isolator design shall be capable of accepting a 15 misalignment in any direction from the vertical.

D. The steel spring element of the assembly shall be designed to have a minimum surge frequency of 340 HZ and a minimum deflection of 3/4 inch.

E. Hanger rod isolators for steam and condensate piping including steam pressure reducing valve stations shall be supported by meals of neoprene-in-shear mountings providing a minimum static deflection of 1/2 inch.

F. Where supplementary steel is required to support piping, the supplementary steel shall be sized so that maximum deflection between supports does not exceed 0.08 inches and shall be resiliently supported from the building structure with mountings as described above. Supported piping from the supplementary steel shall be rigidly suspended or supported.

G. Precompressed type hanger rod isolators shall be provided for all water piping greater than 12 inch diameter and all supplementary steel supports. The precompression shall be factory set at 75% of rated deflection.

H. Piping Guides

1. The all directional pipe anchor isolation mountings shall consist of a telescoping arrangement of two sizes of steel tubing separated by a minimum of 1/2 inch thick heavy duty neoprene and canvas duck isolation pad. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. The allowable load on the isolation material shall not exceed 500 psi.

2. Mountings shall be Type ADA - Mason Industries, Inc., or as approved.

I. Sheet Metal & Piping Penetrations of Shafts, Floor Slab and/or Partitions

1. There shall be no direct contact of Sheet Metal or piping with shaft walls, floor slabs and/or partition. All uninsulated sheet metal or piping shall be packed with caulking the full depth of the penetration.

J. Mounting of Forced Draft Cooling Towers

1. The cooling tower shall be resiliently isolated from the building structure by means of bare stable spring isolators provided between suitably framed grillage and dunnage steel. Approved seismic restraints shall be provided between the grillage and dunnage steel. Spring mounting design shall incorporate a leveling device, neoprene acoustical pad, vertical limit stops to prevent elongation when water is removed from the basin and lateral restraints to safely accept a shear load of two times the supported load without failure. Spring mountings shall provide minimum static deflection of 2 inches and shall be adjusted to operate freely with a minimum operating clearance of 1/4 inch in all directions. All mountings shall be hot dip galvanized (or other approved corrosion protection).

2. The mountings shall serve as blocking during the erection of the towers and after the tower basins have been filled with water. The contractor shall adjust spring mountings to carry the tower and water load resiliently after the tower has been filled. Seismic restraints shall be installed and adjusted after spring mountings have been adjusted.

3. Mountings shall be one of the following, or as approved:

   Type SSLR - M.I.I.
   Type SAWR - V.M.C.I.
   Type BXL - K.D.C.

K. Rigidly Supported Equipment

1. The following equipment shall be rigidly supported:

   a. <u>HVAC</u>

      Ducts
      Ceiling Suspended Expansion Tanks
      Ceiling Suspended VAV and FPB's
      Piping (except resiliently supported as specified above)
      Fuel oil pumps

2. Floor mounted equipment shall be provided with approved seismic control devices, as required, to prevent overturning or sliding.

3. Ceiling supported equipment, including ductwork and piping shall be provided with approve seismic control devices to maintain the equipment in a captive attitude.

L. Seismic Snubber Restraints

1. All floor mounted and resiliently mounted equipment shall be provided with a minimum of four (4) all-direction seismic snubbers. These snubbers shall be double-acting and located as close as possible to vibration isolators to facilitate attachment to equipment base and building structure.

2. Snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials. The elastomeric materials shall be replaceable and a minimum 3/4" thick. Snubbers shall be manufactured with a minimum 1/4" clearance between equipment base mounted section and structure mounted section.

3. Snubber capacity at 3/8" deflection shall be three to four times load assigned to snubber group for equipment. Acceptable products are:

Type Z1011	M.I.I.
Type SR	V.M.C.I.
Type DADR	V.E.C.O.

END OF SECTION

SECTION 15150 - CONTROLS & INSTRUMENTATION

1.1 AUTOMATIC CONTROLS

A. Furnish and install as herein specified, a complete automatic temperature control system as manufactured and installed by Johnson. All temperature controls are to be fully modulating type, except where noted otherwise. The system shall be complete in all respects including thermostats, valves, dampers, relays, etc. and shall be fully compatible with new and existing inter-related systems to provide the functions as specified in "Sequences of Operation". The system shall be installed complete in all respects by competent mechanics, regularly employed by the manufacturer.

B. Control for the VAV and FP boxes shall be pneumatic with type T-4002-201 thermostat for VAV boxes.

C. Control for supplementary air conditioning units and emergency condenser water system will be of electric type.

D. All automatic dampers shall be low leakage type, similar to Ruskin model CD-60. Dampers shall be of the Louvre type with neoprene or vinyl edged blades and end seals.

Frame - 16 GA galvanized steel hat channel.

Blades - Parallel, air foil shaped, double skin construction of 14 GA. equivalent thickness. All rods shall be non-corrosive material with provision for positive interlocking of blades and operators on the shaft.

Bearings shall be nylon or teflon.

Provide solid stops on all sides of the frames against which the louver shall close in order to minimize the leakage. Maximum leakage shall not exceed 3.0 Cfm per sq. ft. at 1" W.G. pressure. Damper actuators should be limited to a minimum of one (1) for every fourth (40) sq. ft. Actuator to be of the electric type.

E. Provide electrical operated motors at two (2) existing butterfly valves on condenser water take-offs in the MER room.

F. Provide new 8" ø motorized valves at the point of connection of emergency condenser water system to the building system.

G. Control air tubing to be extended from the MER to the each VAV, FPB, thermostat, EP switch, etc. Building control air system is supported by the building emergency generator. Control air will be available.

H. All wiring required for complete and operational system, including low and line voltage wiring, to be done under this contract. Provide wiring to all control panels, valves, dampers, EP and PE switches, sensors, thermostats, etc.

I. All wiring to be done in conduits and in accordance with the NEC.

J. Provide a control and monitoring panel (location to be determine by the user) to start/stop and monitor alarm conditions.

K. The following equipment to be monitor (status).

- All AC units
- Cooling Tower
- Condenser Water Pumps
- Emergency Generators
- Fuel Oil Pumps
- Domestic Water Pump

L. The following alarm conditions to be annunciated:

- Emergency shut - Down of every AC unit
- LAN Room - High temperature
- Equipment Room 2350 - High temperature
- Emergency Generator Room - Low temperature
- Cooling Tower Alarms - As listed herein after
- Emergency Generators and Fuel Oil System Alarms - As listed herein after
- Domestic Water Tank - Low level
- Domestic Water Tank - High level
- Transfer Switches - In emergency position
- Leak detection in the water tank room on the 7th floor

1.2 Sequences of operation.

A. Air conditioning units:

1. Watch command room AC unit (AC-6), equipment room AC unit (9AC-4) and LAN room AC units (AC-1 thru AC-3) will be started manually and will be on line continuously.

2. Press room air conditioning unit will be started automatically by the adjustable time clock. Provide an overcall switch to over run time clock operation for predetermine period of time.

3. Starting unit will open automatic damper on the outside air intake duct (where applicable).

4. When started fan will run continuously and room thermostat (built-in sensor) will control operation of compressor and/or electric duct heaters to maintain space conditions.

5. Pressure sensor located on condenser water supply will prevent unit from operation if condenser water is not available.

6. 2-way water regulating valve will control water flow through the unit.

7. Leak detector, located in the drain pan (AC-4) or on the floor next to the unit will shut down respective unit and annunciate at the control and monitoring panel. (location designated by user).

8. All AC units to be connected to the Building Management System for monitoring purposes.

9. Smoke detector to be provide in discharge of each AC unit. Activation of smoke detector will shut-down respective AC unit and annunciate at the building FCS.

10. Each AC unit and exhaust fans to be connected to the building FCS for shut-down in case of emergency.

B. Emergency condenser water system:

1. System will operate only when building condenser water system is not in service.

2. Differential pressure sensor located across condenser water risers will enable supplementary system to operate on a loss of pressure. Provide a manual switch to imitate loss of pressure for testing.

3. System will be started manually.

4. Motorized valves at the building condenser water risers will close.

5. When both valves are in close position (indicated by the end switches) with the time delay motorized valves at the emergency condenser water side will open.

6. End switches, when valves are in open position will start emergency condenser water pump.

7. Differential pressure by-pass valve on the emergency condenser water side will maintain its setting.

8. Aquastat, located on the condenser water supply side, will control operation of cooling tower to maintain water temperature by cycling the fan (2 speed) and spray pump.

9. Fan will be able to start only when automatic louvered dampers on inlet and discharge of cooling tower will be proven open (end switches).

10. Provide following alarm:

    Condenser water temperature - High
    Spray water - Low level
    Spray water - Overflow
    Cooling tower pan - Low temperature
    Vibration - Above normal.

11. When emergency condenser water system will be shut-down, opposite will take place.

END OF SECTION

SECTION 15190 - MISCELLANEOUS

1.1 PACKAGED AIR CONDITIONING UNIT

A. Furnish and install packaged air conditioning unit as scheduled on drawings. Unit shall be provided with standard selector switch and safety controls.

B. See schedules for electrical characteristics and horsepowers. See drawings for control sequence.

C. Furnish standard filters with unit.

1.2 SUPPLEMENTARY UNITS

A. Provide A.R.I. approved supplementary units here shown and scheduled on drawings.

B. Units shall be Climate-Master, Liebert, or approved horizontal or vertical type.

C. Units shall be straight cooling with wall mounted thermostat and sub base, automatic changeover to control cooling and electric heating coil where applicable.

D. Provide manual reset overload protectors.

E. Units shall be factory charged, tested and ready for operation.

F. Unit shall be capable of operation with 45° entering condensing water.

G. Provide differential prewired pressure sensor to allow compressor to start with waterflow.

H. Provide non-locking type disconnect switch.

I. Provide 2 way regulating valve with maximum pressure drop of 5 psig. When power fails or unit is stopped, valve shall close preventing water flow to unit.

J. All regulating valves, and miscellaneous valves and fittings shall be rated at 250 psig

1.3 COOLING TOWER - INDUSTRIAL FLUID COOLERS

A. Furnish and install, as shown on plans, factory assembled industrial fluid cooler of counterflow blow-through design with single side air entry. The industrial fluid cooler shall be of unitary design with all moving parts factory mounted and aligned. All structural elements and steel panels shall be constructed of G210, hot-dip galvanized steel with all edges given a protective coating of zinc-rich compound. After assembly, a paint finish shall be applied to the exterior of the industrial fluid cooler.

B. CAPACITY - The industrial fluid cooler shall have a capacity to cool not less than 130 gpm of water from 108°F to 89°F at 78°F wet bulb temperature. The cooler shall operate against ½ inch external static pressure.

C. PAN SECTION - The pan section shall be constructed of heavy gauge galvanized steel utilizing double break flanges for maximum strength and ridigity and reliable sealing of watertight joint. Standard pan accessories shall include large circular access doors, large are lift-out strainer of anti-vortexing design, and solid brass make-up value with large diameter polystyrene filled plastic float arranged for easy adjustment.

D. FAN SYSTEM - The fans and motors shall be located in the dry entering air stream to provide greater reliability and ease of maintenance. The forwardly curved centrifugal fans shall be statically and dynamically balanced. Fan housing shall have curved inlet rings for efficient air entry. Fans shall be mounted on a steel fan shaft supported by heavy-duty, self aligning, relubricatable bearings with cast iron housings. Furnish 30 hp drip-proof ball bearing fan motor(s) with 1.15 service factor. Motor shall be suitable for outdoor service on 460 volt, 60 hertz, 3 phase electrical service. Motor shall be located on a heavy-duty base, adjustable by means of a single threaded bolt-and-nut arrangement. V-belt fan drive shall be designed for not less than 150% of motor nameplate horsepower. Drive and all moving parts shall be protected by removable hot-dip galvanized screens and panels.

E. COIL SECTION - The heat transfer section shall be integral to the pan section to facilitate rigging and shall include the coil below a spray-type water distribution, all encased by galvanized steel panels. The coil shall be all prime surface steel, have a design pressure of 280 psig, be tested by an encircling eddy current system and also tested at 350 psig air pressure under water. The coil shall be encased in a steel framework and the entire assembly hot-dip galvanized after fabrication. The coil shall be designed for low pressure drop with sloping tubes for fee drainage of liquid refrigerant.

F. WATER DISTRIBUTION SYSTEM - Water shall be distributed evenly over the heat transfer section (on evaporative condensers and industrial fluid coolers a minimum flow rate of 4.5 gpm/sq. ft. of coil cross-section is required to ensure complete wetting of the coil at all times). The system shall consist of Schedule 40 PVC header and spray branches with large diameter, non-clog plastic spray nozzles (360° nozzle for coil products). The branches and spray nozzles shall be held in place by snap-in rubber grommets providing quick removal of individual nozzles or complete branches for cleaning or flushing.

G. WATER RECIRCULATING PUMP - A close coupled, bronze fitted centrifugal pump equipped with a mechanical seal, shall be mounted and completely piped to the suction strainer and water distribution system. A 2 hp pump motor shall be furnished for operation on 460 volt, 60 hetz, 3 phase electrical service.

H. ELIMINATORS - Eliminators shall be constructed of specially formulated PVC and be removable in easily handled sections. They shall have a minimum of three changes in air direction with an air deceleration zone to direct discharge air away from the fans and limit drift loss to less than 0.002% of the total water circulated.

I. UNIT SIZE - Overall dimensions shall not exceed approximately 8 feet x 15 feet with an overall height not exceeding approximately 7 feet. The operating weight shall not exceed 13000 lbs.

The unit shall be Baltimore Aircoil Model VFL-722M or approved.

J. Review rigging options and coordinate shipment arrangement with the manufacturer. If shipped knocked down, field assembly to be done by the manufacturer's mechanics to maintain warranty.

K. CAPACITY CONTROL - Two speed fan motor.

L. FREEZE PROTECTION - 7.0 kw pan emersion heater, 460v, 60 hertz, 3 phase.

M. WATER LEVEL CONTROL - Electric with solenoid valve.

N. SOUND ATTENUATION - Inlet plenum.

O. Additional connection for equalizing line.

1.4 DIESEL EMERGENCY GENERATOR-INTEGRAL RADIATOR:

A. Furnish and install support systems for emergency generator as follows.

1. Ductwork to attach engine radiator to building discharge louvre.

2. Vent piping from day tank to outdoors with insect screen. Make-up air intake louvre and discharge air louvre.

3. Ductwork extension from make-up air louver and non-modulating electric motorized dampers at air intake.

4. Spring return, normally closed non-modulating electric motorized dampers at radiator discharge and in air intake (to close when generator is not running).

5. Spring return normally closed non-modulating motorized electric dampers at load bank discharge (to open when generator is started).

6. Electric heaters and thermostats in generator room to maintain minimum temperature when engine is not running.

7. Diesel fuel storage tank and fill system.

8. Diesel fuel transfer system consisting of supply piping, overflow piping, duplex transfer fuel pumps, automatic alternator, solenoid valve in supply line close to tank to shut down when pump stops. Wiring will be provided so that lag pump starts if lead pump fails to deliver oil.

9. Exhaust pipe extension including installation of mufflers, flexible connection, and "through-wall" thimble.

10. Primary duplex fuel oil pumps shall transfer oil from the primary storage tank to a 275 gal. secondary tank (tank provided by HVAC Trade) Conform to the following. All levels shall be 2 pole.

    a. High - high level alarm.

    b. High level to stop pump (one pole for each pump circuit).

    c. Low level to start lead pump.

    d. Low-low level to start lag pump and alarm (2 pole).

    e. Automatic alternator.

    f. On drop in level below low level the lead pump starts. Lead pump stops at high level. On further drop in level should lead pump fail to supply oil, level will drop to low-low level control to start lag pump and sound alarm. The lag pump stops when level reaches high level control. High-high level sounds alarm.

11. A secondary fuel oil duplex pump mounted on top of the secondary tank (so that any spill will be contained by the tank containment basin) will on activation of any generator distribute oil to a piping loop which returns oil to the tank.

12. The secondary tank shall have a containment basin and shall conform to all local code requirements, including vent, overflow, foot valve on suction line, float, solenoid on supply.

13. Each engine shall connect to the supply side of the loop, and also return oil to the supply side of the loop. Each engine will be furnished by the electrical trade with a solenoid valve activated by the engine.

B. The furnishing and installation of the following is not included in the HVAC work:

    1. Emergency generator.

C. Diesel Oil Tanks

    1. Furnish and install cylindrical fuel oil storage tank of dimensions as follows:
    7'-0" diameter, 22'-0" length,

2. Openings - Provide all openings located on top of shell of each tank. Size of opening for each pipe connection shall be a standard 2" in size and reducers shall be used for size of pipe connected. Each manhole and/or suction bell opening shall have a 1/4-inch thick cover plate and shall be provided with approved heavy ring gasket, (24) 1/2" zinc plated nuts, bolts, washers. Manhole shall be 22" diameter. Provide also a 4" fill tube.

3. Ladder - Shall be standard carbon supplied by the tank manufacturer and shall be 3/8 x 2-1/2 inch bar steel sides not less than 12 inches apart and 3/4 inch diameter steel rod rungs spaced on about 12 inch centers. Ladder shall be properly fastened to tank.

4. Identification - A non-corrosive metal tag to ample size shall be suitably affixed to the tank certifying that the tank shipped or delivered is equivalent to that tested and acceptable for use, as provided for in Section C26-106.2 of the building code.

5. Test - Tank shall be pressure tested at five pounds per square inch pressure.

6. Each tank shall conform to New York City requirement for fuel oil tanks.

7. Furnish and install where directed two (2) calibration charts of determining the amount of oil in the tank when measured with a rod. Furnish (1) rod.

8. Furnish and install all diesel fuel oil piping from storage tank to day tank, fill lines, water tight fill boxes, vents, vent terminals, tank foot valves, and accessories.

D. Tank Gauges

1. Furnish and install on Emergency Diesel Oil Tank, a liquid level gauge operating on the hydrostatic principle, utilizing the two line system. Gauge is to be provided with an aluminum case, drain valve, and glass front to protect the indicating tube and scales. Mounted on gauge shall also be a high-low level alarm switch. The switches will be mounted and shall be designed for a 110 volt system. Locate indicating gauge in emergency generator room.

2. Scales to be calibrated on one side in gallons graduated for equal gallon units based on actual tank dimensions, one the other side in inches graduated for every 1/4" of tank depth.

3. Gauge shall be filled with red indicating fluid having a specific gravity of not more than 3.0.

4. Connections between tank and gauge shall consist of double copper tubing encased in flameproof covering. The copper tubing shall not be less than 1/8" O.D. and provided with suitable end connectors.

5. The tank fitting shall be provided with a 1-1/2" male thread with a stuffing box and stuffing box nut through which 1/2" pressure pipe extends. The pressure fitting shall be provided with a 1/2" female pipe thread. Tank fitting and pressure fitting shall be made of solid bar stock to prevent leak possibilities.

E. Engine Exhaust System

1. Exhaust pipe shall be schedule 40 black steel, welded, from each engine exhaust manifold to a suitable - terminal where shown on plans. Pitch exhaust pipe away from engine and provide drain pocket and valve at low point. The exhaust muffler and flexible piping connector will be furnished by another trade, and installed by this trade. Exhaust piping passing through walls shall pass through a welded steel thimble or other approved device to isolate the wall from exhaust heat.

2. The engine exhaust system & muffler shall be insulated with 3 inch calcium silicate molded insulation of eleven pound density, canvased where exposed.

F. Diesel Oil Transfer Pumps

1. Provide and install a duplex Diesel Fuel Transfer Pump. Pumps shall have a capacity as indicated on drawings. Pump and Motor shall be a complete unit mounted on a cast iron base.

2. Pumps shall be activated by switches in the Day Tank described elsehwere from day tank switches to provide automatic standby operation should lead pump fail.

3. Provide automatic alternator, controlled.

4. Unit shall be furnished with wiring suitable for dual electrical feed.

G. Fuel Oil Piping

1. Furnish and install a complete system of piping with all necessary valves between the fuel oil storage tank and generator day tanks. Provide a swing check valve and gate valve at the pump inlet. Provide approved anti-syphon valve at high points of suction line. Install whatever additional valves may be required by local or state regulations. Piping outside of mechanical spaces and shaft shall be encased in double pipe properly supported and drained. Existing fuel oil riser from the fuel oil pump room to the 8th Floor to be utilized. Risers to be terminated at the 7th Floor and horizontal piping, in the conduit and 2 hours rated enclosure, to be extended from the shaft to the day tank.

2. All piping shall be provided with ground joint unions at piece of apparatus to facilitate connecting and disconnecting.

3. All fuel oil piping, shall be standard weight black steel with standard weight welding fittings.

4. All valves shall be rated for 125 psig steam working pressures.

5. Oil suction line piping shall be tested at 25" vacuum. All other piping shall be tested at 1½ times the design operating pressure prior to backfilling. Submit witnessed affidavit to Engineer.

H. The following alarms to be provided for the emergency generators system:

1. Emergency generator set in operation (each).

2. Emergency generator set - low starting batteries (each).

3. Emergency generator - emergency shut - down.

4. Fuel oil storage tank - low level, high-level, leakage/rupture.

5. Fuel oil day tank - low level, high level, leakage/rupture.

6. Transfer piping leakage.

Provide a safety interlock to prevent operation of the emergency generator if discharge plenum access down is open for service or inspection.

1.5 ELECTRIC DUCT HEATERS:

A. Furnish and install approved electric strip heater assemblies of the open coil, "slip in" type, in horizontal ducts or air handling units or casings as part of the mechanical work. All coils shall be of the highest grade resistance wire (80% nickel, 20% chromium, 0% iron) mounted in a braced aluminized or galvanized iron frame with stainless steel terminals which are insulated with high temperature phenolic or ceramic bushings. Coil shall be factory supplied with approved protective mesh non-corrosive screens. All assemblies, accessories, and installation shall be in conformance with applicable codes and shall bear the UL label.

B. Each strip heater assembly shall be full duct size less any interior lining, and be located where shown and shall have the total wattage rating indicated. Provide approved, upstream and downstream, duct hangers within 12" horizontally of the heater.

C. Each strip heater assembly shall have its elements factory internally wired to balance the load on phase legs.

D. Characteristics of control circuit shall be 2-wire, 120 volt, single phase.

E. Furnish as part of the strip heater assembly, an end mounted terminal box, with removable cover, of sufficient size to properly contain specified appurtenances of this paragraph. Terminal box shall be insulated on the coil side for condensation purposes and shall have suitable ventilation openings. All wiring, control and power shall be factory installed to terminals such that field wiring by the electrical trade shall be limited to power connections and extensions of the control terminals to the room thermostat and sail switch.

1. Furnish for each strip heater assembly, an approved fused, factory mounted, wired control transformer rated for primary operation at not less than the heater assembly line to line voltage.

2. Furnish, for each strip heater assembly, a factory mounted, wired, approved, normally-closed, first contingency thermal cut out device of the auto reset type for operation at control voltage.

3. Furnish, for each strip heater assembly, stage, or circuit, an approved factory mounted, wired (in series with each heater circuit), normally closed, second contingency thermal cut out device of the manual reset type. Device shall be serviceable through terminal box without pulling heater assembly.

4. Furnish, for each strip heater assembly, stage, or circuit, an approved factory mounted, wired, magnetically held, electrically operated mercury type contactor with one full capacity contact for each line terminal of the heater, stage or circuit and a holding coil suitable for control voltage operation.

F. Electrical - Heaters shall be furnished rated for the voltage, phase and number of heating stages indicated in the schedule. Three phase heaters shall have equal, balanced, three phase stages. All internal wiring shall be suitable for 105°C.

G. Control Options - Heaters shall be furnished with thermal cutouts, airflow switch (mercury) (magnetic) contactors, fuses and control circuit transformer.

H. The electric duct heater manufacturer shall furnish and install a multi-stage controller, factory mounted and wired in the electric duct heater terminal box.

I. Provide remote panelboards where scheduled.

J. Where the duct heater is located in a mechanical equipment room, it will be interlocked with the associated fan so that the heater is de-energized when the fan shuts down. Wiring for this interlocking will be by another trade.

1.6 PROPELLER TYPE UNIT HEATERS (ELECTRIC)

A. Furnish and install all unit heaters as shown on the drawings.

B. Unit heaters shall be of the propeller type, suspended as indicated and arranged for horizontal discharge of air. Unit heaters shall be of sizes and capacities as scheduled on the drawings. Heaters shall be of manufacture as noted on drawings or approved.

C. The casing shall be solidly and rigidly built, and finished with lacquer or enamel.

D. Propeller type fans shall be driven by motors of adequate horsepower. Motors shall be provided with thermal overload protection.

E. The heaters shall be controlled automatically by means of local thermostats which shall start and stop the fans as described under "Automatic Temperature Controls."

F. Entrance heating units to be of a capacity as specified in the schedule. Provide fan section and casing construction as outlined in other sections of the specification. Provide 30% medium efficiency filters.

G. Lobby heating units shall be provided with electric heating coil sections with capacities as scheduled on the plans.

1. Electric heaters and controls shall be constructed in accordance with U.L. and NEC requirements.

2. Electric heater frame shall be constructed of heavy duty galvanized steel. All wire terminals and nuts shall be stainless steel. Element wires shall be of A-grade resistance (80% nickel, 20% chromium) and shall be derated to a limit of 35 watts per square inch.

H. Each heater shall be supplied with a built-in automatic reset thermal cut for primary safety protection, replaceable cutouts for secondary safety protection, airflow switch, fan interlock relay, magnetic type contractors (one per step), fuses per NEC, transformer and step controller.

1. All controls shall be housed in a unit mounted control panel with hinged doors, capable of interlock with remote space thermostat.

2. All wiring, control and power, shall be factory installed to terminals such that field wiring is limited to power connections and extension of control terminals to the room thermostat and sail switch.

END OF SECTION

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DIVISION 15300 - FIRE PROTECTION INDEX

Article	Title	Page No.
SECTION 15305- BASIC MATERIALS, METHODS AND REQUIREMENTS (FIRE PROTECTION)		
PART 1 - GENERAL		
1.1	Description	15305-1
1.2	Related Work	15305-5
1.3	Coordination Drawings	15305-8
1.4	Quality Assurance	15305-10
1.5	Submittals	15305-12
1.6	Seismic Design	15305-15
1.7	Applicable Publications	15305-16
1.8	Unit Prices	15305-17
PART 2 - PRODUCTS		
2.1	See Applicable Sections	15305-17
2.2	Electrical Motors, Motor Controls, and Wiring	15305-18
2.3	*Firestopping*	15305-19
2.4	Pipe and Equipment Supports and Restraints	15305-19
2.5	Pipe Sleeves	15305-19
2.6	Tools and Lubricants	15305-19
2.7	Access Doors in Finished Construction	15305-20
2.8	Foundations, Pads and Vibration Isolation	15305-20
2.9	Testing of Fire Safety Systems	15305-20
PART 3 - EXECUTION		
3.1	Installation	15305-21
3.2	Protection and Cleaning	15305-21
3.3	Site Visitation	15305-22
3.4	Connections to Existing Work (and Alterations)	15305-22
3.5	Painting	15305-23
SECTION 15310 - FIRE PROTECTION PIPING		
PART 1 - GENERAL		
1.1	Work Included	15310-1
1.2	Related Work	15310-1
1.3	References	15310-1
1.4	Quality Assurance	15310-1
1.5	Submittals	15310-1

Article	Title	Page No.
PART 2 - PRODUCTS		
2.1	Hangers and Supports	15310-1
2.2	Sleeves and Escutcheons	15310-2
2.3	Drip Pans	15310-4
2.4	Piping Materials	15310-4
2.5	Pipe Joints and Fittings	15310-5
PART 3 - EXECUTION		
3.1	Preparation	15310-5
3.2	Installation	15310-5
3.3	Schedule	15310-7
SECTION 15330 - STANDPIPE AND SPRINKLER SYSTEMS AND EQUIPMENT		
PART 1 - GENERAL		
1.1	Work Included	15330-1
1.2	Related Work	15330-1
1.3	References	15330-1
1.4	Quality Assurance	15330-2
1.5	Submittals	15330-2
PART 2 - PRODUCTS		
2.1	Valves	15330-2
2.2	Sprinkler Control Rig	15330-2
2.3	Sprinkler Drains and Test Connection	15330-2
2.4	Sprinkler Heads	15330-3
2.5	Ladders	15330-3
2.6	Gauges	15330-3
PART 3 - EXECUTION		
3.1	Preparation	15330-4
3.2	Tests	15330-4
3.3	Schedule	15330-4
SECTION 15340 - PREACTION & MISCELLANEOUS SPRINKLER SYSTEMS		
PART 1 - GENERAL		
1.1	Work Included	15340-1
1.2	Related Work	15340-1
1.3	References	15340-1
1.4	Quality Assurance	15340-1
1.5	Submittals	15340-1

Article	Title	Page No.
PART 2 - PRODUCTS		
2.1	Pre-action Sprinkler Systems	15340-2
PART 3 - EXECUTION		
3.1	Preparation	15340-3
3.2	Installation	15340-3
3.3	Schedule	15340-3

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SECTION 15305 - BASIC MATERIALS, METHODS AND REQUIREMENTS (FIRE PROTECTION)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General Conditions shall be considered as forming a part of the specifications and shall be carefully examined before proposals for any work are submitted. Unless the specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions, the specifications shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions.

B. Scope of Work

1. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotations.

C. Codes, Permits and Inspections:

1. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over construction work at the project.

2. All required permits, approval and inspection certificates shall be obtained, paid for, and made available at the completion of the work.

3. Any portion of the work which is not subject to the approval of an authority having jurisdiction, shall be governed by the applicable sections of the overall National Fire Code, as published by the National Fire Protection Association (NFPA).

4. Installation procedures, methods, and conditions shall comply with the latest requirements of The Federal Occupational Safety and Health Act (OSHA).

5. Provide and pay for the cost of the Controlled Inspection as called for in the New York City Building Code, Section C26-106.3 and Section C26-107.3 and for filing all necessary building department reports for approval, Form TR-1, with the building department. Submit the name of the registered Professional Engineer who will be responsible for making the inspections for the Owner on Form TR-1 as soon as possible or within 90 days of the award of contract for approval by the Engineer of Record and Owner and file Form 10F with the building department.

6. All equipment shall comply with "Materials & Equipment Acceptance Division" of N.Y.C. and Board of Standards and Appeals and/or the Advisory Board of the Bureau of Gas and Electricity as applicable. Filing and approvals of such equipment shall be the responsibility of this trade. If equipment is substituted for manufacturers model numbers shown on the contract documents and filed with the building department and/or Advisory Board, this trade shall have the responsibility of preparing and filing amendments with the Building Department. Application for Use Permits shall be filed by this trade.

7. Prepare and submit to the building department a set of "as-built" record drawings for approval, in a form acceptable to the building department.

8. The Contractor shall be responsible for the installation and filing until the installation has been approved by the authorities having such jurisdiction.

D. Guarantees and Certifications

1. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.

2. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.

3. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

4. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of plumbing equipment.

E. Definitions and Interpretations

1. Specific items of terminology, as used herein, shall have the following meanings.

a. "Piping"----------Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids, and gases.

b. "Concealed"----------Embedded in masonry or other construction, installed behind wall furring, within double partitions or hung ceilings, in crawl spaces, in shafts.

c. "Exposed"----------Not concealed.

d. "By Other Trades"-------By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall <u>not</u> be interpreted to mean not included in the overall contract.

F. Interpretation of the Drawings and Specifications

1. As used in the drawings and specifications, certain non technical words shall be understood to have specific meanings as follows:

a. "Furnish"----------Purchase and deliver to the project site complete with every necessary appurtenance and support.

b. "Install"----------Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

c. "Provide"----------"Furnish" and "Install".

2. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

3. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.

4. No exclusions from, or limitations, in the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

5. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

6. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

7. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

8. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

9. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

10. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by Bulletin is subject to the base building specifications in all respects.

1.2 RELATED WORK

A. Section 07250, FIRESTOPPING.

B. Section 07920, SEALANTS AND CAULKING.

C. Section 09900, PAINTING.

D. Division 16, ELECTRICAL

E. Other Sections where applicable.

F. Separation of Work Between Trades

1. The Specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the Fire Protection Work.

2. In the absence of more detailed information, this list shall be taken as a specific instruction to the Fire Protection trade to include the work assigned to it.

3. Indications that the Fire Protection trade is to perform an item of work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

4. Oth = Other than electrical or mechanical

Plb = Plumbing

Spr = Sprinkler and standpipe

Htg = Heating, Ventilating & Air Conditioning

Elec = Electrical

f = Furnished

I = Installed

p = Provided (furnished and installed)

Item	Oth	Plb	Spr	Htg	Elec	Notes
Temporary water	p					
Temporary light & power	p					
Temporary toilets	p					
Temporary fire protection	p					Specification and drawings delineate detailed exceptions.
Hoisting	p					
Rigging	p					
Bracing of building for safe rigging			p			
Cutting, chasing & patching	p					Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade
Fireproof sealing of excess openings in slabs, decks & fire rated walls			p			
Fastenings			p			
Supports			p			
Concrete foundations, pads and bases	p					Furnishing of anchors and vibration mounts included in the Standpipe and Sprinkler Trade.
Field touch up painting of damaged shop coats			p			
Prime coating hangers & supports			p			

Item	Oth	Plb	Spr	Htg	Elec	Notes
Rustproofing field cut and assembled iron supporting frames and racks	___	___	p	___	___	
Finished painting	p	___	___	___	___	
Finished wall and ceiling access doors, panels and supporting frames	p	___	___	___	___	Supplying list locating all required access doors (none to be less than 16" x 16") included in Standpipe and Sprinkler Trade.
Ladders to mechanical equipment and fire protection valves	p	___	___	___	___	Supplying list of locations where required included in the Standpipe and Sprinkler Trade.
Fire hose cabinets and hose	___	___	p	___	___	
Fire extinguishers	p	___	___	___	___	
Fire extinguisher cabinets	p	___	___	___	___	
Rubbish removal	___	___	p	___	___	Where one trade furnishes and another installs, the installing trade removes the shipping and packing materials which accumulate.
Special tools for equipment maintenance	___	___	p	___	___	

5. The Standpipe and Sprinkler Trade is required to supply all necessary supervision and coordination information to any other trades who are to supply work to accommodate the Standpipe and Sprinkler installation.

6. Where the Standpipe and Sprinkler Trade is required to install items which it does not purchase, it shall incl for such items:

   a. The co-ordination of their delivery.

   b. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.

   c. Their safe handling and field storage up to the time of permanent placement in the project.

   d. The correction of any damage, defacement or corrosion to which they may have been subjected.

   e. Their field assembly and internal connection as may be necessary for their proper operation.

   f. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.

   g. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

1.3 COORDINATION DRAWINGS

A. Fire Protection Coordination Drawings

1. This trade shall add to Coordination Drawings prepared by the HVAC Contractor showing all of the fire protection work (equipment, piping, conduit, etc.) to be installed as part of the work of this section of the specifications.

2. This Trade after showing all of the fire protection work shall forward the reproducible Coordination Drawings to the Electrical Contractor.

3. The Fire Protection Contractor shall attend a series of meetings arranged by the General Contractor/Construction Manage to resolve any real or apparent interferences or conflicts with the work of the other Contractors.

4. The Fire Protection Contractor shall them make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts.

5. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Fire Protection Contractor shall "sign-off" the final Coordination Drawings.

6. The Fire Protection Contractor shall not install any of his work prior to "sign-off" of final Coordination Drawings. If the fire protection work proceeds prior to sign-off of Coordination Drawings, any change to the fire protection work to correct the interferences and conflicts which result will be made by the Fire Protection Contractor at no additional cost to the project.

7. Coordination Drawings are for the Contractor's and Architects use during construction and shall not be construed as replacing any shop "as-built", or Record Drawings required elsewhere in these Contract Documents.

8. Architect's review of Coordination Drawings shall not relieve Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

B. Record Drawings

1. As part of the required fire protection work, a complete set of "as-built" or record drawings shall be made up and delivered to the architect.

2. The drawings shall show:-

   a. All work installed exactly in accordance with the original design.

   b. All installed as a modification or addition to the original design.

   c. The dimensional information necessary to delineate the exact location of all piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.

3. Where shop drawings have been prepared and approved, the "as-built" drawings shall be cross referenced to the respective shop drawing. In this case dimensions need not be shown on the "as-builts".

4. As-built record drawings shall include the updating of all equipment schedule sheets.

5. The record drawings shall be of a reproducible type as directed.

6. The Contractor shall make arrangements with the Engineer to obtain design drawings on 1.2 Mb 3-1/2" DOS disks in AutoCad version 12 format for use as a basis for the "as-built" drawings. These documents remain the property of Cosentini Associates LLP and shall be used for no other purpose without expressed, written consent. The contractor shall assume all liabilities resulting from unauthorized use or modifications to the drawings.

7. Prior to developing any "as-built" drawings, the contractor shall coordinate with the Owner and the Architect Engineer the drawing layers, colors, etc., of the CAD drawings.

8. "As-built" information shall be submitted as follows:

   a. CAD drawing files on 1.2 Mb 3-1/2" DOS disks in AutoCad version 12 format.

   b. One (1) set of reproducible drawings.

   c. Two (2) sets of blueprints.

9. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.

10. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.

11. This trade shall submit the "as-built" set for approval by the building department in a form acceptable to the department.

1.4 QUALITY ASSURANCE

A. Products Criteria

1. All equipment furnished as part of the work shall comply with the latest editions of all applicable state and municipal "energy codes." Provide certification from the equipment suppliers for all energy-consuming equipment that the equipment fully complies with these codes. Equipment submissions will not be accepted for review unless accompanied by such certification in writing.

2. All equipment and materials shall be new and without blemish or defect.

3. New equipment and materials shall be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for or where normally subject to such U.L. labeling and/or listing services.

4. Asbestos

   a. All equipment and materials shall be free of asbestos.

5. Electrical equipment and materials shall be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be examined, tested and certified. Where no specific indication as to the type or quality of materials or equipment is indicated, a first class standard article shall be furnished.

6. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction (such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

7. All equipment of one type shall be the products of one Manufacturer.

8. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

9. Note that the approval of shop drawings, or other information submitted in accordance with the requirement hereinbefore specified, does not assure that the Engine Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

10. Substitutions of equipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

11. Prohibition of Lead

    a. The presence and use of lead is strictly prohibited in water systems.

    b. The design and manufacture of all materials and equipment (piping, fittings, joints, connections, *solders, accessories, etc.) provided, shall not contain* lead in any form.

1.5 **SUBMITTALS** In accordance with Section 01340, SAMPLES AND SHC DRAWINGS, furnish the following:

A. Prior to purchasing any equipment or materials, a list of their manufacturers shall be submitted for approval.

B. Prior to assembling or installing the work, the following shall be submitted for approval:

    1. Scale drawings indicating insert and sleeve locations if required by Architect or Structural Engineer.

    2. Scale drawings showing all piping and duct runs with sizes, elevations and appropriate indication of coordination with other trades. This submission to us shall consist of one sepia and 2 paper prints.

    3. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment.

C. Documents will not be accepted for review unless:

    1. They include complete information pertaining to appurtenances and accessories.

2. They are submitted as a package where they pertain to related items, such preaction valve and trim includes wiring diagrams and associated devices.

3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.

4. They indicate the project name and address along with the Contractor's name, address and phone number.

5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

D. Shop Drawing Review

1. The purpose of the review of shop drawings is to maintain integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.

2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

3. Substitutions of equipment, systems, materials, temperature controls must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change electrical requirements, or hanging or support weights or dimensions.

4. Any extra charges or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.

5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filled at the expense of the Contract (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The Contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.

E. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.

2. As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.

3. Resubmit indicates that this item should be resubmitted for approval before further processing.

   a. If both "As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.

4. Not Accepted indicates that the item will not meet the intent of the Contract.

5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

F. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Paragraph, INSTRUCTIONS, for systems and equipment.

2. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.

3. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:

   a. Performance Curves: For pumps, and similar equipment at the operating conditions.

   b. Lubrication Schedule: Indicating type and frequency of lubrication required.

   c. List of Spares: Recommended for normal service requirements.

   d. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.

   e. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.

   f. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.

   g. Automatic Controls: Diagrams and functional descriptions.

4. Where applicable, one set of operating and maintenance instructions shall be neatly framed behind glass and hung adjacent to the equipment concerned.

1.6 SEISMIC DESIGN

A. This project is located within a seismic zone requiring special provisions for the support and restraint of equipment and piping. Such provisions shall be incorporated in accordance with the following:

   1. It shall be understood that the requirements of this seismic sub-section are complementary to requirements delineated elsewhere for the support and fastening of equipment and piping work. Nothing on the drawings or specifications shall be interpreted as a reason to waive the requirements of this seismic sub-section.

   2. For high rise buildings in seismic zone 0, and non critical buildings in zone 1, these requirements pertain only to life safety systems.

3. All rigidly or resiliently installed equipment, piping, etc., shall be capable of withstanding the seismic forc to which it might be subjected without permanent displacement of the equipment from the installed position as required by section 1612.0 of the 1993 BOCA National Building Code and Supplements thereto.

4. Floor mounted equipment shall be provided with approved seismic control devices as required to prevent overturning or sliding. Seismic restraints shall be capable of keeping equipment captive under seismic loads.

5. Ceiling mounted equipment, shall be provided with approved seismic control devices as required to maintain the equipment in a captive attitude under seismic loads.

6. For high rise buildings, the seismic restraint design and construction requirements for equipment and piping incorporated as part of Life Safety Systems shall be such that these systems will remain in place and be functional following a major earthquake, and that the design shall consider lateral drifts between stories as specified by code.

7. As part of the work, the contractor shall engage the services of a professional engineer with experience in the field of equipment support and seismic restraints. He shall select and coordinate the restraints and supports based on the final coordinated drawings showing exact location of piping and equipment and shall coordinate with the structural engineer to ascertain that the connections to the structure will resist the horizontal forces to which they might be subjected. He shall submit details and calculations as required to demonstrate compliance.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

Reference	Definition
ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
NEMA	National Electrical Manufacturers Assn.

USAS	United States of America Standards Institute
ANSI	American National Standards Institute
AWWA	American Water Works Association
F.S.	Federal Specifications, U.S. Government
I.S.O.	Insurance Services Organization

1.8 UNIT PRICES

A. This Contractor's proposal shall state the quantity of each type of sprinkler head on which the proposal was based. Include unit prices (ADD AND DEDUCT) that are to apply for each type of sprinkler head. Unit prices shall include complete installation, receiving, handling, distributing, storing, hoisting, protection, overhead, profit, taxes, etc., and piping, fittings, hangers, escutcheons, heads and all accessories.

B. Certain areas as defined on the plans are to be provided with sprinkler outlets.

C. Sprinkler head and piping layouts will be subject to area requirements and layout. This Contractor shall base his proposal on the total number of estimated sprinkler heads, and shall submit a separate price for the sprinkler heads in his proposal. Areas undefined on the plans as to the number of estimated sprinkler heads shall be based on a coverage of:-

1. For Ordinary Hazard: (1) pendant sprinkler head per one hundred and twenty (120) square feet of finished floor area and one (1) upright sprinkler head per one hundred (100) square feet of storage stock, unfinished area.

2. For Light Hazard: Coverages of (1) pendant sprinkler head per one hundred fifty (150) square feet of finished floor area.

PART 2 - PRODUCTS

2.1 See Applicable Sections

2.2 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Valves

1. Attach a 2" square engraved anodized aluminum or brass tag stamped with designating numbers 1" high filled in with black enamel to each valve, except those on fixtures. Tags shall contain the abbreviation "F.P. above designating number.

2. Securely fasten valve tag to valve spindle or handle with a brass chain.

3. All valves that have an alarm wired back to an alarm panel, shall be identified and coordinated with the numbering system of the alarm panel.

4. Provide approved ceiling tile markers in areas where removable ceilings occur to indicate location of valves or other devices, equipment and fittings which require maintenance service.

B. Schedules and Charts

1. Furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule shall indicate tag number, valve location by floor and nearest column number, valve size and service controlled.

C. Piping Identification and Coding

1. Apply Opti-code pressure sensitive vinyl color coded pipe markers identifying pipe contents and direction of flow.

2. On exposed piping apply markers on 30 foot centers of straight runs, at valve locations, at points where piping enters and leaves a partition, wall, floor or ceiling.

3. On concealed piping installed above removable ceiling construction apply markers in manner described for exposed piping.

4. On concealed piping installed above non-removable ceiling construction, or in pipe shafts, apply markers at valve or other devices that are made accessible by means of access doors or panels.

5. Marker widths shall be 8" for pipes up to 2" diameter and 12" wide for 2-1/2" to 6" diameter piping and 24" wide for larger diameter piping. Letter heights stating service shall be preprinted on marker 3/4" high for 8" markers 1-1/4" high for 12" markers and 2-1/2" high for 24" markers

6. For insulated pipes apply markers after insulation and painting work has been completed.

7. Colors shall conform to ANSI Standard A13.1. Provide 24 additional markers of each type for future use by Owner's personnel.

8. Follow manufacturer's instructions for application procedures using non-combustible materials and contact adhesives. Loop 3/4" wide pressure-sensitive tape of same color as marker background around pipe at both ends of marker and overlap tape on itself a minimum of 2".

9. Markers and tape manufactured by Seton Name Plate Co. or other approved.

2.3 FIRESTOPPING

A. In addition to fire protection means specified elsewhere in this specification, this trade shall comply with the following.

B. All spaces between pipes and their respective sleeves shall be packed full depth with mineral wool, or other equally fire resistant material, and compressed firmly in place. Fiberglass shall not be used. Sleeve clearances shall not exceed ½ inch between pipes (or ducts) and sleeves. Use individual sleeves for each pipe or duct. Before escutcheons are attached caulking must be available for inspection and notification should be made.

2.4 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. See Section 15310 Fire Protection Piping.

2.5 PIPE SLEEVES

A. As per Section 15310 Fire Protection Piping.

2.6 TOOLS AND LUBRICANTS

A. Furnish special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Lubricants: A minimum of one quart of oil, and one pound of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.7 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc. will be provided by another trade.

B. This Trade is responsible for access door location, size and its accessibility to the valves or equipment being served.

C. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing trade.

D. Access doors shall be of ample size, minimum of 16" x 16".

2.8 FOUNDATIONS, PADS AND VIBRATION ISOLATION

A. General

1. All equipment, piping, etc., mounted on/or suspended from approved foundations and supports, as specified, as shown on the drawings.

2. All concrete foundations and supports (and required reinforcing and forms) will be provided by another trade. This trade shall furnish shop drawings showing adequate concrete reinforcing steel details and templates for al concrete foundations and supports, and all required hang bolts and other appurtenances necessary for the proper installation of his equipment. Although another trade will complete all concrete work, all such work shall be shown in detail on the shop drawings, prepared by this trade, which drawings shall be submitted showing the complete details of all foundations including necessary concrete and steel work, etc.

2.9 TESTING OF FIRE SAFETY SYSTEMS

A. This trade shall include in the base bid price sufficient man hours to conduct tests of fire safety systems. The trades shall jointly assign personnel to test the following

1. Electric

2. HVAC Fans and Dampers

3. Automatic Controls and Signals

4. Fire Suppression System (Sprinkler, Standpipe, Halon, etc.)

5. Fire Protective Alarm System

6. Smoke Evacuation Systems

7. Stair Pressurization Systems

B. This trade shall coordinate with other trades and jointly test all systems. When all systems are working properly, inform Owner in writing so that Owner's representative can witness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

3.2 PROTECTION AND CLEANING

A. Cleaning of Piping System (General)

1. During construction, properly cap, plug and cover all openings in pipe, lines and equipment nozzles so as to prevent the entrance of sand, dirt, and foreign matter. Each system of piping shall be flushed (for the purpose of removing grit, dirt, sand, and foreign matter from the piping), for as long a time as is required to thoroughly clean the systems.

B. Adjusting (General)

1. After the entire installation has been completed, make all required adjustments to automatic controls, pressure reducing valves, etc., until all performance requirements are met.

C. All bearings of all equipment shall be oiled or greased as recommended by the manufacturer, after installation.

D. The alignment of each centrifugal pump shall be checked and each pump shall be properly aligned after the pumps are placed in service. Mechanical seals and shaft sleeves shall be replaced by this Contractor without charge in the event that unusual wear or faulty operation occurs during the guarantee period.

E. Cleaning (General)

1. Upon completion of the work, all equipment shall be thoroughly cleaned, polished and left in first class condition for final acceptance.

3.3 SITE VISITATION

A. The contractor shall visit the premises to determine existing conditions and compare same with drawings and specifications and satisfy himself of all conditions prior to the submission of a bid proposal. No allowance will be made for failure to comply with these requirements and a bid proposal shall be construed as evidence he has done so.

B. This contractor shall provide all required labor, materials, equipment and perform all operations for complete demolition, removal and relocation of the existing work as indicated on the drawings and/or as specified or described and/or as required for the performance of the general work under this contract.

C. All existing conditions cannot be completely detailed on the drawings. These include, but are not limited to piping, sprinkler heads, equipment, etc. This contractor shall survey the site and include all required changes in making up their bid proposal.

3.4 CONNECTIONS TO EXISTING WORK (AND ALTERATIONS)

A. Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing facilities. Submit to the Owner for approval, date schedule of necessary temporary shut-downs of existing services. All shutdowns shall be made at such times as will not interfere with regular operation of existing facilities and only after written approval of the Owner. To insure continuous operation, make necessary temporary connections between new and existing work. All costs resulting from temporary shut-downs shall be borne by this Contractor.

B. Connect new work to existing work in neat and approved manner. Restore existing work disturbed to original condition.

C. Alteration

1. Provide alteration work for work as shown on drawings or described herein. If asbestos insulation is present or suspected to be present, inform the Owner in writing so that such removal can be carried out by qualified personnel hired by the Owner. Do not commence demolition until such work has been completed.

2. All piping from existing equipment that will be removed shall be capped or plugged back at risers, inside hung ceilings, inside walls or slabs or below slabs on grade.

3. Existing exposed piping not to be reused, and not specifically noted or shown on drawing to be abandoned shall be completely removed.

4. Concealed abandoned piping need not be removed, if it does not interfere in any way with the new work.

5. The existing systems shall be left in perfect working order upon completion of all new work.

6. Removed existing piping, equipment, etc., shall not be reused unless otherwise indicated.

7. All existing exposed, unnecessary piping related to work being removed shall be completely removed.

8. Any expense required for shutdowns performed by the municipality shall be paid for by the Contractor.

3.5 PAINTING

A. All electrical motors, pump casings, and other apparatus shall be provided with three (3) coats of machinery enamel at the factory and after installation shall be carefully cleaned, rubbed down and oiled.

B. For protective coatings of other equipment such as hangers, etc., refer to that section of the specification wherein construction data is described.

C. Provide prime coat painting for the following:-

1. Miscellaneous steel and iron provided by this trade.

2. Hangers and supports.

END OF SECTION

SECTION 15310 - FIRE PROTECTION PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Piping systems for fire protection.

1.2 RELATED WORK

A. Section 15305 - Basic Materials, Methods and Requirements (Fire Protection).

B. Section 09900 - Painting

1.3 REFERENCES

A. See Section 15305.

B. ANSI/ASME B 31.9.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in piping installation with three years minimum experience.

B. Systems, installation, equipment and materials shall conform to requirements of the local Building Code, Owners Insurance Underwriters, N.Y.C. Fire Department, N.F.P.A., ANSI/ASME B31.9 "Building Service Piping" and all authorities having jurisdiction. Equipment and materials Underwriters listed, labeled and approved as required.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, and list of materials for each service.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 HANGERS AND SUPPORTS

A. Piping shall be supported from the building structure in accordance with National Fire Protection Association Pamphlet No. 13 and 14 latest edition.

B. Support hangers from approved concrete inserts where concrete slabs are available.

C. All hangers, rods, inserts, clamps, stanchions, brackets, shall be dipped in zinc chromite primer before installation or shall be galvanized.

D. Where "C" clamp hanger attachments are utilized, retainer clips shall be provided on each clamp.

E. Piping 3" and smaller shall utilize adjustable swivel loop hangers.

F. Piping 4" and larger shall utilize clevis type hangers only.

G. All hanger rods shall be double nutted.

H. Chain straps, perforated bars, wire hangers are not permitted.

2.2 SLEEVES AND ESCUTCHEONS

A. General

1. Provide sleeves for each pipe passing through walls, partitions, floors.

B. Sleeve Materials

Type Designation	
1	No. 22 USSG galvanized steel.

C. Sleeve Sizes

1. Floors and required fire rated partitions - ½" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

2. Partitions not fire rated - 1-1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

D. Sleeve Lengths

Location	Sleeve Length
Walls & Partitions	Equal to depth of construction and terminated flush with finished surfaces.

E. Sleeve Caulking & Packing

Type Designation	Caulking & Packing Requirements
1.	Space between pipe or pipe covering and sleeve shall be caulked with an incombustible permanently plastic, waterproof non-staining smooth appearance or pack with mineral wool or other equally approved fire resistive material to within ½" of both wall faces and provide caulking compound as per above.

F. Sleeve Application

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	Sleeve Caulking & Packing Type Thru Fire Rated Construction
2	1,	Interior walls, partitions & floors.	A	A

G. Escutcheons

1. Provide escutcheons on all exposed piping passing through walls, floors, partitions and ceilings, except provide close fitting metal escutcheons on both sides of piping (whether exposed or not) through required fire rated walls, floors, partitions and ceilings.

2. Escutcheons shall be held in place by internal spring tension or set screws.

H. Application

Location	
Finished spaces	Anodized aluminum, chrome plated brass.
Unfinished spaces: Excluding mechanical equipment rooms.	Plain brass, cast iron.

2.3 DRIP PANS

A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment. Piping is not permitted in Electric Equipment, Transformer, Switch Gear, Telephone Gear Rooms.

B. Where the installation of piping does not comply with the requirements of foregoing paragraph, where feasible the piping shall be relocated.

C. Furnish gutters as follows:

1. Provide and erect a gutter of 16 ounce cold rolled copper or 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panel-boards, or the like.

2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.

3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

2.4 PIPING MATERIALS

A. See schedule on the drawings for piping materials.

B. Materials indicated are subject to approval of local governing authorities.

C. Each pipe length shall have the manufacturer's name cast, stamped or rolled on.

D. Each fitting shall have the manufacturer's symbol and pressure rating cast, stamped or rolled on, and shall be pressure rated and suitable for the system it is being used for.

E. Steel pipe (Stl.): Welded or seamless, with maker's name stamped or rolled into each length. Pipe shall be black steel ANSI B125.1 and B125.2.

2.5 PIPE JOINTS AND FITTINGS

A. Use the following pipe joints and fittings in accordance with the Pipe Material Schedule shown on the drawings.

B. Joints between lengths of steel pipes: Screwed, flanged or victaulic approved type only. Make screwed joints without the use of lampwick or filler, except "utility compound" or Permacel teflon tape applied to make threads only.

C. Flanged fittings: Cast iron, ductile iron, bronze or cast steel, of required working pressure, as scheduled.

D. Mechanical victaulic type joint

1. For steel pipe victaulic type 77, 75, 72 and zero flex are the only approved coupling to be used with grooved piping. Couplings shall be galvanized when used with galvanized piping. All grooves on piping that is galvanized shall be properly cleaned and provided with zinc chromate primer. See pipe material schedule.

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 INSTALLATION

A. All threads on valves, fire department connections, and other equipment to which local fire department could attach hose provided with hose thread to suit local fire department.

B. All equipment and materials suitable and rated for system water working pressure.

C. Color finish of valve handles, fire department caps and plugs, etc., as required by local fire department.

D. System is a combined fire standpipe and sprinkler system, hydraulically calculated, see article on hydraulic calculations.

E. The drawings and information included in this specification are given as a guide only, and they therefore do not relieve this Contractor from providing all work and equipment necessary to complete the installation according to the requirements. The number and spacing of sprinkler heads, hydraulic calculations, method of draining lines, alarm valves, and all other details and work shall be required by the Local Building Code, Owners Underwriters, N.F.P.A. and all other governing authorities.

F. The sprinkler heads in all areas are to be installed in the center of the tile or centered with lights, diffusers or similar elements as indicated on the architectural reflected ceiling drawings. Sprinkler heads must also be installed on a true axis line in both directions with a maximum deviation from the axis line of ½" plus or minus. At the completion of the installation, if any heads are found to exceed the above mentioned tolerance, same shall be removed and reinstalled by this Contractor at no additional cost to the Owner.

G. No pipes, valves or other apparatus shall be installed so as to interfere in any way with the full swing of the doors.

H. The arrangement, positions and connections of pipes, drains, valves, etc., shown on the drawings shall be taken as a close approximation and while they shall be followed as closely as possible, the right is reserved by the Architect to change the locations, to accommodate any conditions which may arise during the progress of the work without additional compensation to this contractor for such changes, provided that the changes are requested prior to the installation of this Contractor's work. The responsibility for accurately laying out the work rests with this Contractor. Should it be found out that any of his work is so laid out that interferences will occur, he shall also report that to the Architect before installation.

I. Where so shown, or required, piping shall be installed concealed in building construction.

J. All screwed pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split, bent, flattened nor otherwise injured either before or during the installation.

K. Provide all sprinkler heads and work in strict conformance with approved shop drawings. The Architect reserves the right to reject any and all work not in accordance with the approved shop drawing.

L. Whether or not the system shown on the Contract Drawings meets the requirements of the National Fire Protection Association, these specifications require the furnishing and installation of sprinkler systems complete in all details and in accordance with the standards of the National Fire Protection Association.

M. Perform the following in areas where painting occurs or when sprinkler piping is painted. As soon as sprinkler heads are in place and the Contractor shall cover each head with a small bag of an Underwriter's approved type, which shall be removed only after all painting is complete. After the bag is removed, all heads shall be cleaned and polished.

N. Where piping is required to be hung from other than stone concrete slabs, such as pre-cast or metal decking, submit proposed method of support to the structural engineer for approval prior to installation.

O. Piping may be hung from structural steel by means of beam attachments. All auxiliary steel required for support shall be provided by this trade.

P. Do not hang piping from ductwork, except a 1" drop branch to a maximum of two heads.

Q. The Contractor may coordinate with other contractors to use common means of support. Submit for approval all pertinent design data relating to the support as well as verification of the responsibility for the support.

3.3 SCHEDULE

A. As described under products.

END OF SECTION

SECTION 15330 - STANDPIPE AND SPRINKLER SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The system shall include all hose stations, valves, sprinkler heads, drain piping, pressure reducing valves, alarms as required for a complete system.

B. The entire space will be sprinkled with the exception only of electric and telephone closets.

C. All areas will be supplied from a combination standpipe and sprinkler system.

D. Before any work is commenced, shop drawings shall be carefully prepared and submitted for approval. It is required that the sprinkler systems be sized hydraulically in accordance with NFPA standards. Submit hydraulic calculation of each system for each shop drawing, showing balanced system delivery, and balanced supply and demand, as defined for Light Hazard and Ordinary Hazard areas in NFPA 13, latest edition. Such drawings and calculations must be reviewed and approved by all governing authorities, Fire Department, Owners Insurance Underwriters, Factory Mutual and Industrial Risk Insurers before any work is commenced at the jobsite. The mains and risers supplying the fire department valves will remain as sized on the drawings.

E. Fire Pressure Test

1. Obtain up-to-date fire pressure tests indicating the static pressures in the standpipe riser used for sprinkler service.

2. This data must be used in conjunction with Contractor's hydraulic calculations for approval by Engineers.

1.2 RELATED WORK

A. Section 15305 - Basic Materials, Methods and Requirements (Fire Protection).

B. Section 09900 - Painting.

1.3 REFERENCES

A. See Section 15305.

1.4 QUALITY ASSURANCE

A. Company specializing in sprinkler installation with three years minimum experience.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, list of materials and thickness for each service, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 VALVES

A. See schedule on drawings for models and types of valves.

B. Provide on all control and sectional valves, 120 volt closed circuit supervisory tamper switches, shop mounted in accordance with Underwriters IRI, and F.M. standards. Wiring to alarm panel is under other sections of the work.

2.2 SPRINKLER CONTROL RIG

A. See detail on drawings. Existing sprinkler floor central valve to be utilized or modified as indicated.

B. Sprinkler control rigs shall contain all controls, test alarms, and drain apparatus at sprinkler tap points. Existing alarms shall be maintained.

2.3 SPRINKLER DRAINS AND TEST CONNECTION

A. Provide all necessary drain valves, drain piping, capped nipples, auxiliary piping, etc., as required to drain the system and all trapped portions of the system. Drain valves which are not connected to drain pipes leading to floor drains shall be hose end type.

B. Main drains and test connections shall be piped to waste.

C. Provide all piping required to spill the drains and test connections to the floor, funnel or other drainage connections provided under the Plumbing Contract, or arrange with the Plumbing Trade to provide additional drainage facilities, in which case pay all charges related to the additional Plumbing Construction work.

D. Provide Inspectors Test connections at end of systems in accordance with Section 3082 of N.F.P.A. Pamphlet No. 13, and as required by Local Fire Department or authorities having jurisdiction. Pipe to waste and include sight connection as necessary.

2.4 SPRINKLER HEADS

A. Provide approved automatic spray sprinkler heads of Reliable Automatic Sprinkler Co., or other approved manufacturer.

B. Head locations, type and finish as scheduled on the drawings.

C. All heads shall be of the proper temperature rating for the locations in which they are installed.

D. Provide stock of extra sprinkler heads, sprinkler wrenches in accordance with Article 3660 of N.F.P.A. Pamphlet No. 13. Cabinets shall be Reliable or other approved.

2.5 LADDERS

A. Steel ladders to all valves located 7 ft. or as required by local authorities above finished floor will be provided by others.

B. This Trade shall furnish a location list of all required ladders to the installing trade.

2.6 GAUGES

A. Provide pressure gauges in accordance with the following schedule and as shown on the plans.

B. Gauges shall have a 4-1/2" diameter dial, white coated with black figures and graduations, cast iron case with flat friction fit rings. Gauges shall be Ashcroft No. 1010 or other approved. Shutoff cock Ashcroft No. 1092, or other approved, shall be provided between gauge and piping to permit gauge removal while system is under pressure.

Gauge Location	Pressure Range
Each sprinkler control valve rig	0 - 250 p.s.i. or as required

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 TESTS

A. Provide all designating signs for shutoff valves, control valves, alarms, and the like, as required by the agencies having jurisdiction.

B. Testing of Systems

1. Perform all required tests in the manner prescribed by and to the satisfaction of the local building department and N.Y. City fire department, Owners Insurance Underwriters, and all authorities having jurisdiction. Owners and Architects representatives shall be present to inspect tests. Obtain all required certificates of approval and pay any fees or costs in conjunction therewith.

2. Provide and pay for all devices, materials, supplies, labor and power required in connection with all tests. All tests shall be made in the presence and to the satisfaction of the Architect and inspectors having jurisdiction.

3. Defects disclosed by the tests shall be repaired, or if required by the Architect, defective work shall be replaced with new work without extra charge to the Owner. Tests shall be repeated as directed, until all work is proven satisfactory.

4. This Contractor shall also be responsible for the work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his own work, and he shall, without extra charge to the Owner, restore to its original condition, work of the trades so damaged and disturbed, engaging the original Contractors to do the work of restoration.

3.3 SCHEDULE

A. See schedule on the drawings for manufacturer type and model numbers of the equipment listed below:-

1. Pressure reducing valves.

2. Hose stations with all accessories.

3. Hose cabinets.

4. Sprinkler heads.

END OF SECTION

SECTION 15340 - PREACTION & MISCELLANEOUS SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide approved type automatic sprinkler pre-action systems consisting of closed sprinkler heads properly spaced to cover the areas protected including electrically operated deluge valves actuated by properly spaced electric smoke and heat type detector heads, and manual break glass releases. Primary electric power source shall be 120 volt A.C. current with transformation and rectification to 24 volt D.C. for system operation. Provide all electric work from 120 volt power source. Secondary power source by means of 24 volt storage batteries and battery charger. Automatically maintained low air pressure source. System shall be in full accordance with the requirements of the National Fire Protection Association and shall be Underwriters Laboratory, UL listed, FM approved. Provide automatic pre-action sprinkler system for:- Area(s) indicated on drawings.

B. Refer to drawings for detail and notes.

1.2 RELATED WORK

A. Section 15305 - Basic Materials, Methods and Requirements (Fire Protection).

B. Section 15310 - Fire Protection Piping.

1.3 REFERENCES

A. See Section 15305.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in sprinkler installation with three years minimum experience.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, list of materials and thickness for each service, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 PRE-ACTION SPRINKLER SYSTEMS

A. Pre-action system operation and basic components as follows:

1. Check valve on discharge side of deluge valve to retain supervisory air pressure.

2. Deluge valve to withhold release of water in system.

3. External reset provision to facilitate testing of deluge valve.

4. Electric releases to retain or release clapper in deluge valve.

5. Release control panel to supervise and control release mechanism.

6. End-line resistors to regulate supervisory current in detector units.

7. Trouble signal and bell to signal circuit faults.

8. Power supply panels to provide primary power supply to release mechanism.

9. Storage battery units to provide secondary source of power supply.

10. Tamper switches to supervise O.S.&Y. control valves, control valves to control water supply to deluge valve.

11. Detector heads to initiate operation of release mechanisms through release control panels.

12. Emergency break glass stations for manual provisions for operating detector heads.

13. Electric alarm switches to operate electric alarms upon water flow.

14. Supervisory air supply, self-contained, with air compressor panel, air compressor, check valve, pressure gage, tubing, audible and visual alarm, silence switch, O.S.& Y. monitor switch.

15. Air maintenance device w/valve, filter, regulator, low pressure alarm, pressure gage, check valve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Non-applicable.

3.2 INSTALLATION

A. See Section 15310, Fire Protection Piping.

3.3 SCHEDULE

A. See drawings.

END OF SECTION

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DIVISION 15400 - PLUMBING INDEX

Article	Title	Page No.
PART 1 - GENERAL		
1.1	Description	15405-1
1.2	Seperation of Work Between Trades	15405-5
1.3	Coordination Drawings	15405-9
1.4	Quality Assurance	15405-11
1.5	Submittals	15405-13
1.6	Seismic Design	15405-16
1.7	Applicable Publications	15405-18
1.8	Unit Prices	15405-19
PART 2 - PRODUCTS		
2.1	See Applicable Sections	15405-19
2.2	Drive Guards	15405-19
2.3	Electrical Motors, Motor Controls and Wiring	15405-20
2.4	Equipment and Materials Identification	15405-20
2.5	Firestopping	15405-22
2.6	Pipe and Equipment Supports and Restraints	15405-22
2.7	Pipe Sleeves	15405-22
2.8	Tools and Lubricants	15405-22
2.9	Access Doors in Finished Construction	15405-23
PART 3 - EXECUTION		
3.1	Installation	15405-23
3.2	Protection and Cleaning	15405-23
3.3	Site Visitation	15405-24
3.4	Connections to Existing work (and Alterations)	15405-24
3.5	Painting	15405-25
3.6	Equipment Provided Under Other Sections of the Work that Requires Plumbing	15405-26
3.7	Appliances, Toilet Room Accessories and Trim	15405-27
3.8	Architectural Coordination and Samples	15405-27

SECTION 15410 - PLUMBING PIPING

PART 1 - GENERAL		
1.1	Work Included	15410-1
1.2	Related Work	15410-1
1.3	References	15410-1
1.4	Quality Assurance	15410-1
1.5	Submittals	15410-1

Article	Title	Page No.
PART 2 - PRODUCTS		
2.1	Domestic Water System	15410-1
2.2	Sanitary and Storm Water Drainage System	15410-3
2.3	Materials for Piping Systems	15410-4
2.4	Pipe Joints and Fittings	15410-6
2.5	Cleanouts	15410-8
2.6	Traps	15410-9
2.7	Hangers, Supports, Anchors and Guides	15410-9
2.8	Sleeves and Escutcheons	15410-15
2.9	Drip Pans	15410-17
2.10	Thermometers and Gauges	15410-18
2.11	Strainers	15410-18
2.12	Valves	15410-19
PART 3 - EXECUTION		
3.1	Preparation	15410-20
3.2	Installation	15410-20
SECTION 15440 - PLUMBING FIXTURES AND EQUIPMENT		
PART 1 - GENERAL		
1.1	Work Included	15440-1
1.2	Related Work	15440-1
1.3	References	15440-1
1.4	Quality Assurance	15440-1
1.5	Submittals	15440-1
PART 2 - PRODUCTS		
2.1	Shock Absorbers	15440-1
2.2	Hose Bibbs	15440-2
2.3	Plumbing Fixtures	15440-2
2.4	Domestic Water Heaters	15440-4
2.5	Suction Tank Steel	15440-7
2.6	Alarms for Suction Tank	15440-8
2.7	Drains	15440-9
PART 3 - EXECUTION		
3.1	Preparation	15440-10
3.2	Installation	15440-10
3.3	Schedule	15440-10

Article	Title	Page No.
SECTION 15445 - PLUMBING PUMPS		
PART 1 - GENERAL		
1.1	Work Included	15445-1
1.2	Related Work	15445-1
1.3	Quality assurance	15445-1
1.4	Submittals	15445-1
PART 2 - PRODUCTS		
2.1	Sump Pumps	15445-1
2.2	Domestic Water Constant Pressure Booster System	15445-2
2.3	Domestic Water Transfer Pump System	15445-5
PART 3 - EXECUTION		
3.1	Installation	15445-7
3.2	Schedule	15445-7
SECTION 15450 - INSULATION FOR PLUMBING		
PART 1 - GENERAL		
1.1	Work Included	15450-1
1.2	Related Work	15450-1
1.3	References	15450-1
1.4	Quality Assurance	15450-1
1.5	Submittals	15450-2
PART 2 - PRODUCTS		
2.1	Insulation for Piping & Equipment	15450-3
PART 3 - EXECUTION		
3.1	Preparation	15450-5
3.2	Installation	15450-5
3.3	Schedule	15450-6

Article	Title	Page No.
SECTION 15486 - FOUNDATIONS, VIBRATION ISOLATION, & SUPPORTS FOR RIGIDLY SUPPORTED EQUIPMENT (SEISMIC DESIGN)		
PART 1 - GENERAL		
1.1	Work Included	15486-1
1.2	Related Work	15486-1
1.3	Quality Assurance	15486-1
1.4	Submittals	15486-1
PART 2 - PRODUCTS		
2.1	Vendors	15486-2
2.2	Mounting Type I-P - Mounting of Centrifugal Pumps - Located on Slab on Grade (Slab Bearing on Earth)	15486-2
2.3	Mounting of Prefabricated Water Booster Pump Systems	15486-3
2.4	Vertical Water Heaters Mounting Type VII-P	15486-3
2.5	Suction Tanks and Retention Tanks Mounting Type VIII-P	15486-3
2.6	Support of Piping - Piping in and Adjacent to Equipment Rooms	15486-3
2.7	Piping Risers, Anchors, Guides, Pump Lines	15486-4
2.8	Piping Penetrations of Building Shafts Floor Slabs, Walls, Partitions, Etc.	15486-5
2.9	Rigidly Supported Equipment	15486-5
2.10	Seismic Snubber Restraints	15486-5
PART 3 - EXECUTION		
3.1	Preparation	15486-6
3.2	General	15486-6
SECTION 15991 - TESTING OF SYSTEMS		
PART 1 - GENERAL		
1.1	Work Included	15991-1
1.2	Related Work	15991-1
1.3	References	15991-1
1.4	Quality Assurance	15991-1
1.5	Submittals	15991-1
PART 2 - PRODUCTS		
Not Applicable		

Article	Title	Page No.
PART 3 - EXECUTION		
3.1	Preparation	15991-1
3.2	Installation	15991-1
3.3	Domestic Water Systems	15991-2
3.4	Sanitary, Storm Drainage and Lab Waste System	15991-2
3.5	Testing of Fire Safety Systems	15991-2
SECTION 15996 - MISCELLANEOUS PLUMBING SYSTEMS		
PART 1 - GENERAL		
1.1	Work Included	15996-1
1.2	Related Work	15996-1
1.3	References	15996-1
1.4	Quality Assurance	15996-1
1.5	Submittals	15996-1
PART 2 - PRODUCTS		
2.1	*HWAT Self-Regulating Temperature* Maintenance for Domestic Hot Water Piping	15996-1
2.2	Leak Detection System	15996-4
PART 3 - EXECUTION		
3.1	Preparation	15996-4
3.2	Installation	15996-4
3.3	Schedule	15996-4

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SECTION 15405 - BASIC MATERIALS, METHODS AND REQUIREMENTS (PLUMBING)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General Conditions shall be considered as forming a part of the specifications and shall be carefully examined before proposals for any work are submitted. Unless the specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions, the specifications shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions.

B. Scope of Work

1. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotations.

C. Basic methods and requirements for Division 15, Mechanical, applies to all sections of Division 15.

D. Codes, Permits and Inspections:

1. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over construction work at the project.

2. All required permits, approval and inspection certificates shall be obtained, paid for, and made available at the completion of the work.

3. Any portion of the work which is not subject to the approval of an authority having jurisdiction, shall be governed by the applicable sections of the overall National Fire Code, as published by the National Fire Protection Association (NFPA).

4. Installation procedures, methods, and conditions shall comply with the latest requirements of The Federal Occupational Safety and Health Act (OSHA).

5. Provide and pay for the cost of the Controlled Inspection as called for in the New York City Building Code, Section 27-132 and Section 27-136 and for filing all necessary building department reports for approval, Form TR-1, with the building department. Submit the name of the registered Professional Engineer who will be responsible for making the inspections for the Owner on Form TR-1 as soon as possible or within 90 days of the award of contract for approval by the Engineer of Record and Owner and file Form TR-1 with the building department.

6. All equipment shall comply with "Materials & Equipment Acceptance Division" of N.Y.C. and Board of Standards and Appeals and/or the Advisory Board of the Bureau of Gas and Electricity as applicable. Filing and approvals of such equipment shall be the responsibility of this trade. If equipment is substituted for manufacturers model numbers shown on the contract documents and filed with the building department and/or Advisory Board, this trade shall have the responsibility of preparing and filing amendments with the Building Department. Application for Use Permits shall be filed by this trade.

7. Prepare and submit to the building department a set of "as-built" record drawings for approval, in a form acceptable to the building department.

8. The Contractor shall be responsible for the installation and filing until the installation has been approved by the authorities having such jurisdiction.

E. Guarantees and Certifications

1. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.

2. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.

3. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

4. Non-durable replaceable items such as water filter media do not require replacement after the date of acceptance. If received in writing, requests to have earlier acceptance dates established for these items will be honored.

5. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of plumbing equipment.

F. Definitions and Interpretations

1. Specific items of terminology, as used herein, shall have the following meanings.

a. "Piping"----------Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids, and gases.

b. "Concealed"----------Embedded in masonry or other construction, installed behind wall furring, within double partitions or hung ceilings, in crawl spaces, in shafts.

c. "Exposed"----------Not concealed.

d. "By Other Trades"-------By persons or parties responsible for work at the project other than the party or parties who have been duly awarded the contract for the work of this Trade. In the event that this document is used to acquire work as part of a general construction contract the words "by other trades" shall mean by persons or parties who are not anticipated to be the sub-contractor for this trade working together with the general contractor. In this context the words "by other trades" shall <u>not</u> be interpreted to mean not included in the overall contract.

G. *Interpretation of the Drawings and Specifications*

1. As used in the drawings and specifications, certain non technical words shall be understood to have specific meanings as follows:

a. "Furnish"----------Purchase and deliver to the project site complete with every necessary appurtenance and support.

b. "Install"----------Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

c. "Provide"----------"Furnish" and "Install".

2. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

3. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.

4. No exclusions from, or limitations, in the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

5. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

6. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

7. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field co-ordination for the indicated work.

8. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

9. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

10. In the event that extra work is authorized, and performed by this trade, work shown on drawings depicting such work, and/or described by Bulletin is subject to the base building specifications in all respects.

1.2 SEPARATION OF WORK BETWEEN TRADES

A. The Specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the Plumbing Work.

B. In the absence of more detailed information, this list shall be taken as a specific instruction to the Plumbing trade to include the work assigned to it.

C. Indications that the Plumbing trade is to perform an item of work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

D. Oth = Other than electrical or mechanical

Plb = Plumbing

Spr = Sprinkler and standpipe

Htg = Heating, Ventilating & Air Conditioning

Elec = Electrical

f = Furnished

I = Installed

p = Provided (furnished and installed)

Item	Oth	Plb	Spr	Htg	Elec	Notes
Temporary water	p	___	___	___	___	
Temporary light & power	p	___	___	___	___	

Item	Oth	Plb	Spr	Htg	Elec	Notes
Temporary toilets	p					
Temporary fire protection	p					Specification and drawings delineate detailed exceptions.
Hoisting	p					
Rigging	p					
Bracing of building for safe rigging		p				
Cutting, chasing & patching	p					Cost where due to late installation or improper coordination of work is the responsibility of the delinquent trade
Fireproof sealing of excess openings in slabs, decks & fire rated walls		p				
Fastenings		p				
Supports		p				
Floor drain flashing		p				
Concrete foundations, pads and bases	p					Furnishing of anchors and vibration mounts included in the Plumbing Trade.
Field touch up painting of damaged shop coats		p				
Prime coating hangers & supports		p				

Item	Oth	Plb	Spr	Htg	Elec	Notes
Rustproofing field cut and assembled iron supporting frames and racks	___	p	___	___	___	
Finished painting	p	___	___	___	___	
Finished wall and ceiling access doors, panels and supporting frames	p	___	___	___	___	Supplying list locating all required access doors (none to be less than 16" x 16") included in Plumbing Trade.
Cat walks to mechanical equipment	p	___	___	___	___	Supplying list of locations where required included in the Plumbing Trade.
Ladders to mechanical equipment and fire protection valves	p	___	___	___	___	Supplying list of locations where required included in the Plumbing Trade.
Fire hose cabinets and hose	___	___	p	___	___	
Fire extinguishers	p	___	___	___	___	
Fire extinguisher cabinets	p	___	___	___	___	
Domestic make-up water piping for heating and air conditioning systems	___	p	___	___	___	Final connections included in heating, ventilating and air conditioning.
Toilet room accessories	f	___	___	___	___	Install certain toilet room accessories as required by local trade union jurisdiction.

Item	Oth	Plb	Spr	Htg	Elec	Notes
Soap dispensers on fixtures and piped soap systems	___	p	___	___	___	
Food service equipment	p	___	___	___	___	Line connections included in Plumbing.
Pre-cast and/or molded receptors (mop basins, shower floors, etc.)	___	p	___	___	___	
Rubbish removal	___	p	___	___	___	Where one trade furnishes and another installs, the installing trade removes the shipping and packing materials which accumulate.
Special tools for equipment maintenance	___	p	___	___	___	

5. The Plumbing Trade is required to supply all necessary supervision and coordination information to any other trades who are to supply work to accommodate the Plumbing installation.

6. Where the Plumbing Trade is required to install items which it does not purchase, it shall include for such items:

   a. The co-ordination of their delivery.

   b. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.

   c. Their safe handling and field storage up to the time of permanent placement in the project.

   d. The correction of any damage, defacement or corrosion to which they may have been subjected.

   e. Their field assembly and internal connection as may be necessary for their proper operation.

f. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.

g. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

h. Items which are to be installed but not purchased as part of the work of the Plumbing Trade shall be carefully examined by this trade upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of the Plumbing Trade will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work of the Plumbing Trade shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.3 COORDINATION DRAWINGS

A. Plumbing Trade Coordination Drawings

1. This Trade shall add to Coordination Drawings prepared by the HVAC Contractor showing all of the plumbing work (equipment, piping, conduit, etc.) To be installed as part of the work of this section of the specifications.

2. This Trade after showing all of the plumbing work shall forward the reproducible Coordination Drawings to the Sprinkler Contractor.

3. The Plumbing Contractor shall attend a series of meetings arranged by the General Contractor/Construction Manager to resolve any real or apparent interferences or conflicts with the work of the other Contractors.

4. The Plumbing Contractor shall then make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts.

5. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Plumbing Contractor shall "sign-off" the final Coordination Drawings.

6. The Plumbing Contractor shall not install any of his w prior to "sign-off" of final Coordination Drawings. If the plumbing work proceeds prior to sign-off of Coordination Drawings, any change to the plumbing work to correct the interferences and conflicts which result will be made by the Plumbing Contractor at no additional cost to the project.

7. Coordination Drawings are for the Contractor's and Architect's use during construction and shall not be construed as replacing any shop, "as-built", or Record Drawings required elsewhere in these Contract Documents.

8. Architect's review of Coordination Drawings shall not relieve Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

C. Record Drawings

1. As part of the required plumbing and fire protection work, a complete set of "as-built" or record drawings shall be made up and delivered to the architect.

2. The drawings shall show:-

   a. All work installed exactly in accordance with t. original design.

   b. All installed as a modification or addition to the original design.

   c. The dimensional information necessary to delineate the exact location of all piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.

3. Where shop drawings have been prepared and approved, the "as-built" drawings shall be cross referenced to the respective shop drawing. In this case dimensions need not be shown on the "as-builts".

4. As-built record drawings shall include the updating of all equipment schedule sheets.

5. The record drawings shall be of a reproducible type as directed.

6. The Contractor shall make arrangements with the Engineer to obtain design drawings on 1.2 Mb 3-1/2" DOS disks in AutoCad version 12 format for use as a basis for the "as-built" drawings. These documents remain the property of Cosentini Associates and shall be used for no other purpose without expressed, written consent. The contractor shall assume all liabilities resulting from unauthorized use or modifications to the drawings.

7. Prior to developing any "as-built" drawings, the contractor shall coordinate with the Owner and the Architect Engineer the drawing layers, colors, etc., of the CAD drawings.

8. "As-built" information shall be submitted as follows:

   a. CAD drawing files on 1.2 Mb 3-1/2" DOS disks in AutoCad version 12 format.

   b. One (1) set of reproducible drawings.

   c. Two (2) sets of blueprints.

9. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.

10. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.

11. This trade shall submit the "as-built" set for approval by the building department in a form acceptable to the department.

1.4 QUALITY ASSURANCE

A. Products Criteria

1. All equipment furnished as part of the work shall comply with the latest editions of all applicable state and municipal "energy codes." Provide certification from the equipment suppliers for all energy-consuming equipment that the equipment fully complies with these codes. Equipment submissions will not be accepted for review unless accompanied by such certification in writing.

2. All equipment and materials shall be new and without blemish or defect.

3. New equipment and materials shall be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for or where normally subject to such U.L. labeling and/or listing services.

4. Asbestos

   a. All equipment and materials shall be free of asbestos.

5. Electrical equipment and materials shall be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be examined, tested and certified. Where no specific indication as to the type or quality of materials or equipment is indicated, a first class standard article shall be furnished.

6. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performar requirements with lesser construction (such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

7. All equipment of one type such as drains, pumps, fixtures, etc. shall be the products of one Manufacturer.

8. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

9. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

10. Substitutions of equipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

11. Prohibition of Lead

    a. The presence and use of lead is strictly prohibited in potable water systems.

    b. Potable water shall <u>not</u> be subject to contact with lead in any form.

    c. The design and manufacture of all materials and equipment (piping, fittings, joints, connections, solders, fixtures, accessories, etc.) provided, shall not contain lead in any form.

    d. Contractor shall be responsible for all costs involved in testing and certifying that potable water systems, materials and equipment are lead free.

1.5 SUBMITTALS In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

A. Prior to purchasing any equipment or materials, a list of their manufacturers shall be submitted for approval.

B. Prior to assembling or installing the work, the following shall be submitted for approval:

1. Scale drawings indicating insert and sleeve locations if required by Architect or Structural Engineer.

2. Scale drawings showing all piping and duct runs with sizes, elevations and appropriate indication of coordination with other trades. This submission to us shall consist of one sepia and 2 paper prints.

3. Catalog information, factory assembly drawings and fie installation drawings as required for a complete explanation and description of all items of equipment.

C. Documents will not be accepted for review unless:

1. They include complete information pertaining to appurtenances and accessories.

2. They are submitted as a package where they pertain to related items.

3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.

4. They indicate the project name and address along with the Contractor's name, address and phone number.

5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

D. Shop Drawing Review

1. The purpose of the review of shop drawings is to maint. integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.

2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

3. Substitutions of equipment, systems, materials, temperature controls must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change electrical requirements, or hanging or support weights or dimensions.

4. Any extra charges or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.

5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filled at the expense of the Contractor (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The Contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.

E. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.

2. As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.

3. Resubmit indicates that this item should be resubmitted for approval before further processing.

   a. If both "As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.

4. Not Accepted indicates that the item will not meet the intent of the Contract.

5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

F. *Maintenance Data and Operating Instructions:*

1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Paragraph, INSTRUCTIONS, for systems and equipment.

2. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.

3. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:

   a. Performance Curves: For pumps, and similar equipment at the operating conditions.

   b. Lubrication Schedule: Indicating type and frequency of lubrication required.

   c. List of Spares: Recommended for normal service requirements.

   d. Parts List: Identifying the various parts of t equipment for repair and replacement purposes.

   e. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.

   f. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.

   g. Automatic Controls: Diagrams and functional descriptions.

4. Where applicable, one set of operating and maintenance instructions shall be neatly framed behind glass and hung adjacent to the equipment concerned.

1.6 SEISMIC DESIGN

A. This project is located within a seismic zone requiring special provisions for the support and restraint of equipment and piping. Such provisions shall be incorporated in accordance with the following:

1. It shall be understood that the requirements of this seismic sub-section are complementary to requirements delineated elsewhere for the support and fastening of equipment and piping work. Nothing on the drawings or specifications shall be interpreted as a reason to waive the requirements of this seismic sub-section.

2. For high rise buildings in seismic zone 0, and non critical buildings in zone 1, these requirements pertain only to life safety systems.

3. All rigidly or resiliently installed equipment, piping, etc., shall be capable of withstanding the seismic forces to which it might be subjected without permanent displacement of the equipment from the installed position as required by section 1612.0 of the 1993 BOCA National Building Code and Supplements thereto.

4. Floor mounted equipment shall be provided with approved seismic control devices as required to prevent overturning or sliding. Seismic restraints shall be capable of keeping equipment captive under seismic loads.

5. Ceiling mounted equipment, shall be provided with approved seismic control devices as required to maintain the equipment in a captive attitude under seismic loads.

6. For high rise buildings, the seismic restraint design and construction requirements for equipment and piping incorporated as part of Life Safety Systems shall be such that these systems will remain in place and be functional following a major earthquake, and that the design shall consider lateral drifts between stories as specified by code.

7. As part of the work, the contractor shall engage the services of a professional engineer with experience in the field of equipment support and seismic restraints. He shall select and coordinate the restraints and supports based on the final coordinated drawings showing exact location of piping and equipment and shall coordinate with the structural engineer to ascertain that the connections to the structure will resist the horizontal forces to which they might be subjected. He shall submit details and calculations as required to demonstrate compliance.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
NEMA	National Electrical Manufacturers Assn.
USAS	United States of America Standards Institute
ANSI	American National Standards Institute
AWWA	American Water Works Association
F.S.	Federal Specifications, U.S. Government
C.S.	Commercial Standards issued by the United States Department of Commerc
M.S.S.	Manufacturers Standardization Society of the Valve and Fittings Industry
A.G.A.	American Gas Association, Inc.
A.S.H.R.A.E.	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
P.D.I.	Plumbing and Drainage Institute
N.S.F.	National Sanitation Foundation
A.S.S.E.	American Society of Sanitary Engineering
I.A.P.M.O.	International Association of Plumbing and Mechanical Officials
C.I.S.P.I.	Cast Iron Soil Pipe Institute
A.A.S.H.O.	American Association of State Highway Officials

NYCBS & A New York City Board of Standards and Appeals

1.8 UNIT PRICES

A. This Contractor shall state in his proposal unit prices in accordance with the following schedule:

B. Unit prices set forth hereunder shall include the providing of fixtures with all trim, fittings, roughing, final connections, hanger, carriers, supports, inserts, insulation when required, etc. and all other materials required for the complete installation of each fixture. The Contractor shall include in the unit prices set forth, receiving, handling, distribution, storing, hoisting, protection, overhead, profit, taxes, etc., for each item and shall include all roughing to a point measured horizontally to within two feet of the fixture.

C. Piping unit prices shall include the piping with hangers, supports, insulation and fittings.

D. Unit prices per item completely installed shall be submitted, but not limited to the following items listed below. Submit separate Add and Deduct prices for each item:

1. Piping cost per linear foot of each type, material and size.

2. Plumbing fixture cost per each type of fixture installed.

3. Drains - cost per each drain (floor, roof, area, etc.) of each type and size.

4. Valves - cost per each type with insulation if required and size.

PART 2 - PRODUCTS

2.1 See Applicable Sections

2.2 DRIVE GUARDS

A. For machinery and equipment provide guards.

B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secures so as to be removable without disassembling pipe, or electrical connections to equipment.

C. Access for Speed Measurement: One inch diameter hole at each shaft center.

2.3 ELECTRICAL MOTORS, MOTOR CONTROLS, AND WIRING

A. Provide all electric motors for driving plumbing equipment. All motors shall be of proper power and speed to suit the specified makes of equipment; if other makes of equipment (other than specified) are accepted in any case, the proper adjustment of motor speed and power must be included without additional cost to Owner. Sizes and type shall be submitted for approval before the equipment is purchased.

B. All motors and accessories shall comply in all respects with the most recent practice of the I.E.E.E., the National Board of Fire Underwriters and National Fire Protection Association.

C. Motors shall be thoroughly ventilated. When running continuously at full load and full speed, temperature rise above surrounding air shall not exceed 40 degrees C.

D. All motors shall be of proper power and speed to suit the specified working condition under which they will function, the proper adjustment of motor speed and power must be included without additional cost to Owner. Motors shall have a service factor of 1.15.

E. Motors shall be suitable for use at the available supply voltage. Nameplate voltage ratings shall be as follows:

a. Single phase motors 115 volts

b. Three phase motors:

1) Supplied at 208 volts 200 volts

2) Supplied at 460 or 480 volts 460 volts

Note that 208 volt or 208-230 volt or 208- 230/460 volt motors will not be acceptable.

2.4 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Valves

1. Attach a 2" square engraved anodized aluminum or brass tag stamped with designating numbers 1" high filled in with black enamel to each valve, except those on fixtures. Tags shall contain the abbreviation "PLBG" above designating number.

2. Securely fasten valve tag to valve spindle or handle with a brass chain.

3. All valves that have an alarm wired back to an alarm panel, shall be identified and coordinated with the numbering system of the alarm panel.

4. Provide approved ceiling tile markers in areas where removable ceilings occur to indicate location of valves or other devices, equipment and fittings which require maintenance service.

B. Motor Control Identification

1. Mount black lamacoid nameplates on each motor controller identifying primary control duction and individual position indication such as Pump No. 1, etc. Nameplates shall be cut through to white background and have beveled edges. Mount with chromiun plates acorn head screws.

C. Schedules and Charts

1. Furnish to Owner's Representative three (3) complete framed plastic laminated valve tag schedules. Schedule shall indicate tag number, valve location by floor and nearest column number, valve size and service controlled.

D. Piping Identification and Coding

1. Apply Opti-code pressure sensitive vinyl color coded pipe markers identifying pipe contents and direction of flow.

2. On exposed piping apply markers on 30 foot centers of straight runs, at valve locations, at points where piping enters and leaves a partition, wall, floor or ceiling.

3. On concealed piping installed above removable ceiling construction apply markers in manner described for exposed piping.

4. On concealed piping installed above non-removable ceiling construction, or in pipe shafts, apply markers at valve or other devices that are made accessible by means of access doors or panels.

5. Apply markers at exit and entrance points to each vessel, tank or piece of equipment.

6. Marker widths shall be 8" for pipes up to 2" diameter and 12" wide for 2-1/2" to 6" diameter piping and 24" wide for larger diameter piping. Letter heights stating service shall be preprinted on marker 3/4" high for 8" markers 1-1/4" high for 12" markers and 2-1/2" high for 24" markers.

7. For insulated pipes apply markers after insulation and painting work has been completed.

8. Colors shall conform to ANSI Standard A13.1. Provide 24 additional markers of each type for future use by Owner's personnel.

9. Follow manufacturer's instructions for application procedures using non-combustible materials and contact adhesives. Loop 3/4" wide pressure-sensitive tape of same color as marker background around pipe at both ends of marker and overlap tape on itself a minimum of 2".

10. Markers and tape manufactured by Seton Name Plate Co. or other approved.

2.5 FIRESTOPPING

A. In addition to fire protection means specified elsewhere in this specification, this trade shall comply with the following.

B. All spaces between pipes and their respective sleeves shall be packed full depth with mineral wool, or other equally fire resistant material, and compressed firmly in place. Fiberglass shall not be used. Sleeve clearances shall not exceed ½ inch between pipes (or ducts) and sleeves. Use individual sleeves for each pipe or duct. Before escutcheons are attached caulking must be available for inspection and notification should be made.

2.6 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. See Section 15410 Plumbing Piping.

2.7 PIPE SLEEVES

A. As per Section 15410 Plumbing Piping.

2.8 TOOLS AND LUBRICANTS

A. Furnish special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Lubricants: A minimum of one quart of oil, and one pound of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.9 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc. will be provided by another trade.

B. This Trade is responsible for access door location, size and its accessibility to the valves or equipment being served.

C. Coordinate and prepare a location, size, and function schedule of access doors required and deliver to a representative of the installing trade.

D. Access doors shall be of ample size, minimum of 16" x 16".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

3.2 PROTECTION AND CLEANING

A. Cleaning of Piping System (General)

1. During construction, properly cap, plug and cover all openings in pipe, lines and equipment nozzles so as to prevent the entrance of sand, dirt, and foreign matter. Each system of piping shall be flushed (for the purpose of removing grit, dirt, sand, and foreign matter from the piping), for as long a time as is required to thoroughly clean the systems.

B. Adjusting (General)

1. After the entire installation has been completed, make all required adjustments to balancing valves, air vents, automatic controls, circulators, flush valves, faucets, pressure reducing valves, etc., until all performance requirements are met. All water circulating systems shall be properly balanced.

C. Cleaning (General)

1. Upon completion of the work, all fixtures, trimmings and equipment shall be thoroughly cleaned, polished and left in first class condition for final acceptance.

3.3 SITE VISITATION

A. The contractor shall visit the premises to determine existing conditions and compare same with drawings and specifications and satisfy himself of all conditions prior to the submission of a bid proposal. No allowance will be made for failure to comply with these requirements and a bid proposal shall be construed as evidence he has done so.

B. This contractor shall provide all required labor, materials, equipment and perform all operations for complete demolition, removal and relocation of the existing work as indicated on the drawings and/or as specified or described and/or as required for the performance of the general work under this contract.

C. All existing conditions cannot be completely detailed on the drawings. These include, but are not limited to piping fixtures, equipment, etc. This contractor shall survey the site and include all required changes in making up their bid proposal.

3.4 CONNECTIONS TO EXISTING WORK (AND ALTERATIONS):

A. Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing facilities. Submit to the Owner for approval, dat schedule of necessary temporary shut-downs of existing services. All shutdowns shall be made at such times as will not interfere with regular operation of existing facilities and only after written approval of the Owner. To insure continuous operation, make necessary temporary connections between new and existing work. All costs resulting from temporary shut-downs shall be borne by this Contractor.

B. Connect new work to existing work in neat and approved manner. Restore existing work disturbed to original condition.

C. Alteration

1. Provide alteration work for work as shown on drawings or described herein. If asbestos insulation is present or suspected to be present, inform the Owner in writing so that such removal can be carried out by qualified personnel hired by the Owner. Do not commence demolition until such work has been completed.

2. See Architectural Drawings for identification of equipment and fixtures that will be removed.

3. All piping from existing equipment and fixtures that will be removed shall be capped or plugged back at stacks, inside hung ceilings, inside walls or slabs or below slabs on grade.

4. In no case on sanitary piping shall dead end runs remain.

5. Existing exposed piping not to be reused, and not specifically noted or shown on drawing to be abandoned shall be completely removed.

6. Concealed abandoned piping need not be removed, if it does not interfere in any way with the new work.

7. The existing systems shall be left in perfect working order upon completion of all new work.

8. Removed existing piping, fixtures, etc., shall not be reused unless otherwise indicated.

9. All existing exposed, unnecessary piping related to work being removed shall be completely removed.

10. Any expense required for shutdowns performed by the municipality shall be paid for by the Contractor.

11. Certain existing vents thru the roofs will be reused. It will be this contractor's responsibility to support the existing vent at clg. below roof properly before cutting into it so that the existing membrane, and flashing will not be disturbed.

3.5 PAINTING

A. All electrical motors, pump casings, and other apparatus shall be provided with three (3) coats of machinery enamel at the factory and after installation shall be carefully cleaned, rubbed down and oiled.

B. For protective coatings of other equipment such as hangers, etc., refer to that section of the specification wherein construction data is described.

C. Provide prime coat painting for the following:-

1. Miscellaneous steel and iron provided by this trade.

2. Hangers and supports.

3.6 EQUIPMENT PROVIDED UNDER OTHER SECTIONS OF THE WORK THAT REQUIRES PLUMBING

A. Certain equipment (casework, kitchen, etc.) will be supplied under other sections of the work. This Contractor shall provide as described below the requirements and all necessary services roughing and final connections as shown on the plans and as required.

B. Installation of the equipment shall be performed in the following manner.

1. Roughing: Provide all water, waste, vent piping and special laboratory services (acid waste and vent piping, gas, air vacuum, etc.) complete in accordance with detailed dimensioned drawings, to be provided by the equipment suppliers. This roughing shall be left ready for final connection to tables and equipment terminated at a point and height indicated by the Equipment Suppliers drawings.

2. Setting of Equipment: The Equipment Supplier will furnish and set in place and secure all equipment.

3. Final Connection: This trade shall make all final connections after the equipment has been set in place.

4. Trim: The Equipment Supplier will furnish all specialized appliances and trim such as faucets, tailpieces, strainers, service outlet bibbs, cocks, serrated hose connections and other related trim. This Trade shall coordinate and check with the Equipment Supplier and shall provide all valve, traps, stops, escutcheons, branch control valves, floor and funnel drains, nipples, fittings, tailpieces, pressure reducing valves, vacuum breakers, check valve, and other appurtenances which are not supplied by the Equipment Supplier and are necessary to the operating characteristics of the equipment being furnished. Also install all trim furnished with the equipment, as required, in accordance with the manufacturer's recommendations.

5. All exposed to view final connection piping, fittings, valves, etc., shall be chrome plated with finish matching equipment rim finishes. Submit finish samples to Architect for approval. Attention is hereby drawn to the Equipment Specifications being prepared under other sections of the work.

C. Review all Architectural drawings and equipment cuts for all equipment locations & services required at each piece of equipment.

3.7 APPLIANCES, TOILET ROOM ACCESSORIES AND TRIM

A. Handle and install all Plumbing connected appliances claimed under Plumber's jurisdiction from tailboard delivery, including hoisting and rigging to designated locations.

B. Handle and install all accessories and trim claimed under Plumber's jurisdiction.

C. Dispose of all appliance and accessories packing crates and debris off of the site.

3.8 ARCHITECTURAL COORDINATION AND SAMPLES

A. All devices and appurtenances which are to be installed in all finished areas must be coordinated with the Architect for final approval as it relates to location, finish, materials, color, texture, etc.

B. Submit samples of all materials requested by the Architect.

C. Samples shall be prepared and submitted with all postage and transportation costs paid by the Contractor submitting same. Label each sample with identifying numbers and titles.

D. Submit samples of:-

1. All exposed to view finishes such as cleanout plates, access covers, drain grates and tops, fixture trim, fresh air inlet plates, etc.

END OF SECTION

SECTION 15410 - PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide complete systems including all material equipment, piping, controls, alarms, tests, and all required appurtenances necessary to serve all outlets and equipment requiring service. The system installation and performance shall conform to all requirements of the National Fire Protective Association regulations and ANSI/ASME B31.9 - 1982 "Building Services Piping."

B. All material shall be new and installed in a first class manner.

1.2 RELATED WORK

A. Section 15405 - Basic Materials, Methods and Requirements (Plumbing).

B. Section 09900 - Painting.

C. Section 15450 - Insulation for Plumbing

1.3 REFERENCES

A. ANSI/ASME B31.9 Building Services Piping.

1.4 QUALITY ASSURANCE

A. Installer. Company specializing in piping systems with five years minimum experience.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, list of materials for each service, and locations.

C. Submit manufacturers installation instructions under provision of Section 01300.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER SYSTEM

A. All water piping shall be arranged to drain to low points and to provide for air elimination at high points.

B. Mains, risers and branch connections to same shall be arranged to permit expansion and contraction without strain by means of elbow swings and/or expansion joints.

C. All valves, check valves, reducing valves, shock absorbers, tempering valves, etc. shall be easily accessible for maintenance an/or removal.

D. All screwed joints shall be made with best quality pure red leads as approved pipe compound, carefully placed on male threads only and not on the fittings.

E. All cut and threaded pipe shall have the cutting burrs and sharp edges reamed out.

F. Provide air chambers on branch piping to fixtures if required by local code.

G. In erecting pipe, friction wrenches shall be used exclusively, and any pipe cut, dented or otherwise damaged shall be replaced.

H. All ferrous to non-ferrous pipe connections shall be made with Epco Sales Inc., or other approved dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.

I. All piping shall be cut square and reamed to remove all burrs. Outside and inside of the fitting and outside of piping at each end shall be well cleaned with steel wool before soldering to remove all traces of oxidation regardless of how clean the surfaces of the pipe and fittings may appear.

J. All materials and method of installation shall conform to the requirements of applicable codes.

K. Nipples: Any piece of pipe 8" in length and less shall be considered a nipple. All nipples with unthreaded portion 1 ½" and less shall be extra heavy. All other nipples shall be of weight corresponding to fittings connected. Only shoulder nipples shall be used, close nipples will not be acceptable.

L. All exposed to view piping in finished areas shall be brass chrome plated pipe and fittings.

M. Provide unions and control valves at connections to each piece of equipment for easy dismantling and at such other points to facilitate installation. Unions shall be of same strength, and manufacture used in the respective piping systems and of ground joint type.

N. Valved outlets shall be left for the HVAC Contractor and as indicated on the plans.

O. Submerged Inlets

1. Provide point of use double check valves reduced pressure back flow prevention and/or vacuum breakers as required by the codes having jurisdiction on all hot and cold water supplied to fixtures and equipment requiring inlet connections wherein a minimum air break cannot be attained.

P. Air Vent Valves

1. Provide where indicated on the plans and as required, automatic air vent valves on hot water supply piping. Provide waste connectors and route blow-off piping to nearest floor drain or mop sink. Provide air gap dimension of 2 times diameter of each blow-off pipe. All exposed blow-off piping in finished areas shall be polished chrome plated. Valves shall be Sarco Co., Type 13 W.

2.2 SANITARY AND STORM WATER DRAINAGE SYSTEM

A. All drainage piping, unless otherwise indicated shall be pitched at a minimum rate of 1/8" per foot in direction of flow. Branch connections to stacks or main drains shall pitch at 1/4" per foot where possible and shall not be made in a manner which will permit backflow.

B. All vent piping shall be arranged to drain any condensate back to waste piping.

C. All screwed joints shall be made with best quality pipe joint compound, carefully placed on the threads of pipe and not on the fittings.

D. All cut and threaded pipe shall have the cutting burrs and sharp edges reamed out.

E. All connections between galvanized steel and cast iron pipe shall be caulked with oakum and lead, the end of the galvanized steel pipe shall be fitted with a ring or part of a coupling screwed on to form a spigot.

F. Nipples: Any piece of pipe 8" in length and less shall be considered a nipple. All nipples shall be weight corresponding to fitting connected. Only shoulder nipples shall be used unless otherwise directed.

G. Provide and install Test Tees in verical soil, waste and leader stacks at intervals to permit testing in sections, as not to delay work program as a whole.

H. Ferrules shall be of the best quality of "Extra Heavy" cast brass.

2.3 MATERIALS FOR PIPING SYSTEMS

A. Use the following materials in the various piping systems, in accordance with the pipe material schedule on the drawings.

B. This contractor will be required to submit a list for approval for all piping to be used, manufacturers name and pressure ratings for all systems.

C. Listed below are references to the specification standards of recognized authorities to which pipe and fitting materials must conform to be acceptable. All reference shall be the latest edition in force at the time of bidding.

D. Materials indicated are subject to approval of local governing authorities.

E. Each pipe length shall have the manufacturer's name cast, stamped or rolled on.

F. Each fitting shall have the manufacturer's symbol and pressure rating cast, stamped or rolled on, and shall be pressure rated and suitable for the respective system.

G. Material Chart:

	Standards and Authority Spec. Number			
Material	A.N.S.I.	A.S.T.M.	F.S.	Remarks
Lead Sheet			QQ-L-201F (2)	
Copper Sheet		B-152		
Chrome Plating for Pipe & Fittings				Minimum Thickness 0.00002" Chromium Deposited over & minimum thickness of .0002" nickel plating

Material	A.N.S.I.	A.S.T.M.	F.S.	Remarks
Brazing Alloy		B-260 B-CUP-5	QQ-S-561d	
Brazing Flux				Harmons "Handy-Flux"
Soft Solder 50-50 Tin Lead		B-32 Grade 50A	QQ-S-571d	
Soft Solder 95-5 Tin- Antimony		B-32 Grade 5A	QQ-S-571d	
Caulking Lead, (New Soft Pig)			QQ-C-40	
Galvanized		A525 Sheet Steel		
Soft Solder 96-4 Tin-Silver			QQ-S-571 d (SN-96)	
Compound-Fixture Setting			HH-C-536a TT-P- 001536	IAMPO
Air Gap	A40.4			
Anti-Siphon Vacuum Breakers Atmospheric Type Pipe Applied	A112.1.1			ASSE 1001
Reduced Pressure Principle Back- flow Preventors				ASSE 1013
Gaskets-Plumbing Fixture Setting				HH-G-116
Water Hammer Arresters	A112.26.1			
Backflow Preventers	A-40.6			
Coal-Tar Enamel Protective Coating For Steel Pipe				C-203
Galvanizing				Hot process inside and outside of pipe w/zinc coating, minimum 2 oz. per sq.ft.

H. Cast iron soil pipe (C.I.): Uncoated standard weight or if required by local code only extra heavy cast iron soil pipe, hub and spigot type, for lead and oakum caulked joints or rubber gasket push on type joints or coated service weight no-hub type as scheduled with size, weight per foot and maker's name clearly cast or stamped on each length. Pipe shall be manufactured by a member of the Cast Iron Soil Pipe Institute.

I. Copper tubing seamless drawn or extruded tubing Type "L" or Type "K" as scheduled hard temper in accordance with ASTM Specification B-88, with solder joint sweat end fittings.

J. Copper tubing Hard temper Type DWV copper drainage tubing furnished in 20 foot straight lengths, in accordance with ASTM Specification B-306-56T.

K. Red brass pipe (R.B.P.): Seamless annealed drawn tubing, iron pipe size, containing a mixture of not less than 85% copper, in accordance with ASTM B-43.

L. Steel pipe (Stl.): Schedule as indicated on the drawings, welded or seamless, with maker's name stamped or rolled into each length. Pipe shall be black, hot dip galvanized, or mill wrapped as scheduled in accordance with ANSI B125.1 and B125.2.

2.4 PIPE JOINTS AND FITTINGS

A. Use the following pipe joints and fittings in various piping systems in accordance with the Pipe Material Schedule, shown on the drawings.

B. Cast iron no-hub piping (mech. joint - no hub)

1. All cast iron no-hub piping shall be made up and installed to comply with Cast Iron Soil Pipe Institute Standard. Coupling shall be "Husky" Orange Shield HD 4000 as manufactured by Huskey Technologies, a Division of Anaheim Foundry Company with extra wide heavy duty corrugated type 304 stainless steel shield, neoprene gasket, (4) heavy duty stainless steel clamps and bolts for sizes 4" and smaller (6) six for sizes 5" and larger. Clamps to be tightened to 80 inch pounds of torque. Clamp-All 125 with 100% neoprene gasket only, will be accepted as an equal.

2. No-hub joints shall be used for all penetrations through radio frequency controlled rooms.

C. Cast iron hub and plain end gasketed joints. (Mech. joint gasketed.)

1. Elastometric Gaskets for Cast Iron Soil Pipe: Made of DuPont Co., Neoprene and shall be Central Foundry Co. "Multi-Tite" lubricant, Tyler Pipe and Foundry "Lubri-Fast" lubricant, or other approved, shall be applied to gasket and pipe sigot for make-up of joints. Gaskets shall be extra heavy soil pipe.

D. Cast iron hub & spigot caulked joints.

1. Cast iron pipe shall have joints made with picked oakum and molten lead made impermeable to gas by bedding solidly to oakum, and caulked with hammer and caulking iron. The yarning with oakum for all caulked joints shall not be permitted of greater depth in hub than 3/4". The hubs must be filled with lead so that when caulking is completed, it will finish flush with the face thereof and present a smooth appearance. An approved soft pig lead must be used for caulking.

E. Joints between lengths of steel pipes: Drainage piping-cast iron drainage pattern couplings; other - standard malleable iron couplings with flat band. All joints in steel pipe: Screwed, flanged or welded as scheduled. Make screwed joints without the use of lampwick or filler, except "utility compound" or Permacel teflon tape applied to make threads only.

F. Solder fittings for use with copper tubing: Wrought or cast brass fittings, American Brass Co., or as approved, of drainage pattern or standard design as required.

G. Joints for copper tubing shall be made with 95-5 (tin and antimony) solder.

H. Brass screwed fittings: Weight as scheduled, flat band, ips. No plain couplings permitted. Make joints in brass pipes without the use of lampwick of filler except Permacel teflon tape, or "utility compound" applied to male threads only.

I. For joints between cast iron and steel pipe and vent connections to vent hubs on carrier fittings, screw a half-coupling on the steel pipe to form spigot head, make a caulked joint as specified for cast iron pipe.

J. Provide dielectric couplings for water piping penetrations through radio frequency controlled rooms where indicated.

2.5 CLEANOUTS

A. Provide cleanouts where indicated at all changes in direction on horizontal piping. Distance between cleanouts on horizontal runs shall be made accessible by means of approved deck plates, access covers and doors.

B. Access doors and frames for cleanouts located behind walls will be furnished by the Plumbing Trade and installed under another section of the work. A complete list of wall cleanout locations shall be furnished to the installing contractor prior to erection of walls.

C. Where cleanouts occur in floors they shall be compatible with the surrounding finished surface.

D. All cleanout plugs shall be brass and lubricated with graphite before installation.

E. Cleanouts occurring in cast iron soil pipe above floor at change in direction of pipe run and at ends of horizontal runs shall be with cast iron ferrule for caulk connection and fitted with a straight threaded, tapered bronze plug with raised hex head.

F. All cleanout plugs shall be up with graphite and oil to facilitate easy removal. No pipe compound is to be used on plugs.

G. Cleanouts shall be provided with adjustable clamping collar devices where flashing and/or waterproof floor and slabs occur.

H. Finish of cleanout deck plates and rims in floors shall be: scoriated nickel bronze in finished areas and scoriated bronze in unfinished areas (mechanical, storage, etc. areas).

I. The cleanout schedule as listed below indicates the particular cleanout desired at the various locations and represents the features and standard of quality desired.

J. Cleanouts

1. Manufacturer's Model No.

Josam	Location
58890	In piping above floor at change in direction of pipe run and ends of horizontal runs.

Josam	Location
56000	Non-waterproof floors and slab.
56000-12-96	Asphalt tile, non-waterproof floor and slabs.
56000-41-X	Waterproof floors and slabs
56000-41-X	Waterproof floors and slabs Carpeted Floors.

2.6 TRAPS

A. Sanitary Drainage Systems

B. Traps in drainage piping system: Cast brass, cast iron and/or galvanized cast iron, one-piece pattern, 3" minimum seal, of the same material in which they are installed, except traps 2" ips and under not buried in earth shall be cast brass.

C. Fixture traps: Cast brass regulation "P" traps with 2" minimum trap seal and gasketed cleanout plugs made of machined bar stock.

2.7 HANGERS, SUPPORTS, ANCHORS AND GUIDES

A. Seismic Design

1. As noted in "Seismic Design", the Plumbing Contractor shall engage the services of a professional engineer with experience in the field of equipment support and seismic restraints (or an approved piping expert who has specialized in piping design). The Engineer shall select and coordinate the restraints and supports based on the final coordinated drawings showing exact location of piping and equipment and shall coordinate with the structural engineer to ascertain that the connections to the structure will resist the horizontal forces to which they might be subjected. He shall submit details and calculations as required to demonstrate compliance.

B. Seismic Restraints below shall be installed to restrain and protect piping in the event of an earthquake and shall be installed in addition to pipe hangers, brackets and supports. Seismic Restraints shall not be used in lieu of regular hangers and supports as are otherwise required to support the piping.

C. All required supports, hangers, anchors, and guides shall be provided and installed by this contractor. Shop drawings shall be submitted indicating the following.

1. Methods of hanging or supporting all mechanical equipment & piping furnished by this trade.

2. Multiple piping whether by other trades or not, if included on a trapeze type hanger furnished by this trade shall similarly indicate weights.

D. General

1. Hanger design shall conform to ANSI Code for Pressure Piping and the Manufacturers Standardization Society of the Valve and Fitting Industry (MSS) SP-58 and SP-69.

2. Specified bracket clamp and rod sizes are minimum size. This Trade is responsible for structural integrity of all supports. Supports shall have safety factor of 5 built in.

3. Installed supports shall prevent excessive deflection and bending stresses between supports and vibration.

E. Submitals

1. Submit manufacturers catalog data, inserts, rods, hangers, anchors, guides, trapeze.

2. Submit method of support and hanging for structural engineers approval prior to installation.

F. Installation

1. All pipe supports of type and arrangement as specified, arranged to prevent excessive deflection, avoid excessive bending stresses between supports and vibration.

2. All bracket clamp and rod sizes indicated in this specification are minimum sizes only. This trade shall be responsible for structural integrity of all supports.

3. Approved type trapeze hangers may be used instead of separate clevis hangers with suspension rods having double nuts and securely attached to the construction in an approved manner.

4. Maximum weights on hanger rods assuming a maximum operating temperature of 450 degrees F. shall be such that stress in tension shall not exceed 9000 psi, using root area of threaded portion.

5. Provide lead or fiber shields between hangers and clamps for uninsulated brass or copper pipe and tubing.

6. Provide auxiliary steel required for pipe supports in areas where building structure is not convenient. In pipe shafts, closets, at floors which are not slabbed over and where building structure is not suitable for pipe supports, provide steel members, channels, angles or "Unistrut" components for piping support.

7. All hangers, rods, inserts, clamps, stanchions, brackets, shall be dipped in zinc chromate primer before installation or shall be galvanized.

8. Chain straps, perforated bars, or wire hangers are not permitted. Branch piping to fixture in pipe spaces shall be supported by using Sumner supports, Kindorf or B'Line supports. This contractor shall provide supports on a few typical installations for approval before proceeding with the entire installation (wire for supports is prohibited).

9. Resilient hangers and isolation material provided on all piping connected to rotating equipment (pumps, etc.) and other piping that may vibrate and create an audible noise.

10. Coordinate with other trades and avoid interferences.

11. All pipe supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structure, equipment, etc.

12. Install pipe hangers outside of the insulation and where hangers occur, inserts and saddles shall be installed between pipe and inside of hanger. See "Insulation" specification for details.

13. Piping located near floors which can be supported from walls or floor shall be provided with approved floor stands, wall brackets, roller supports, masonry piers, etc.

G. Pipe Hanger Schedule

	Witch by C & P	Michigan Hanger	Grinnell
Beam Clamp	268	354	--------
Clevis Hanger	100EL	415	300
Clevis Hanger	100 CI		590
180 Degree Shield	265P	80	--------
Pipe Saddle	351	630	180
Rigid Trapeze	371	---	STD 45
U-Bolt	283	150	137
Adj. Steel Pipe Stanchion	247	720	259
180 Degree Shield	265P	125	167
Welded Steel Bracket	84	352	195
	139	353	199
Riser Clamp	126	510	261
Base Elbow Support	375	---	------
Double Bolt Pipe Clamp	304-Z	452	295
Welded Beam Attachment	113A	---	66
Welded Beam Attachment W/B&N	113B	320W	66

H. Horizontal Piping Support Spacing

Pipe Material	Pipe Size	Location & Max. Distance Spacing Interval Between Supports in Feet	Support Type	Note
Cast Iron Soil Pipe	All Sizes	At every hub or joint at 5'-0" max. intervals except for pipe lengths exceeding 5'-0", then at max. 10'-0" intervals.	As per Hanger Schedule & Specification	Addition supports where concentration of fittings occur.
Copper Tube	1-1/4" and smaller	6'-0"	As per Hanger Schedule & Specification	
	1-1/2" and larger	10'-0"		
Pipe (S.P.S.) (I.P.S.)	3/4" and smaller	6'-0"		
Steel, Brass and Copper	2" to 5"	10'-0"		
	6" & larger	12'-0"		

I. Vertical Piping Support Spacing

Pipe Material or Service	Location and Max. Distance Bet. Supports	Support Type	Note
Cast Iron Hub and Spigot Soil Pipe	At each floor	Riser Clamp double bolt or other approved	Riser clamp arms to have equal bearing on building structure

Pipe Material or Service	Location and Max. Distance Bet. Supports	Support Type	Note
Copper Tube	At each floor	Riser Clamp double bolt or other approved	Provide auxiliary steel where riser clamps are too short to connect to bldg. structure

J. Support of No-Hub Cast Iron Soil Piping System

1. Due to flexible nature of no-hub piping system, provide complete support, sway bracing, rigidity and stability of all components of the no-hub system. Supports generally to be provided as follows:

Horizontal Piping - Support Spacing

Pipe Size	Location & Max. Distance Spacing Interval Between Supports in Feet	Support Type
All Sizes	At each joint at 5'-0" max. intervals. Sway bracing support between joints, where required to prevent horizontal sway, prevent sagging and maintain alignment locate as per field conditions. Supports at each branch connection.	As per Hanger Schedule and Specification

Vertical Piping - Support Spacing

Pipe Size	Location & Max. Distance Spacing Interval Between Supports in Feet	Support Type
All sizes	Support at each floor Sway bracing support between joints to prevent horizontal sway, prevent sagging and maintain alignment; locate as per field conditions supports at each branch connection	Riser clamp double bolt or other approved at floors. Pipe clamp with rod and insert and support at center line between floors.

K. Hanger Rod Schedule

Pipe Size	Rod Size
2" and smaller	3/8"
2-1/2" to 6"	½"

L. Piping Hanger Connection Schedule

1. Pipe hangers shall be connected to building structure as follows:

Building Structure Type	Pipe Support Method
Building Structure Steel	Beam Attachments. Where "C" clamp hanger attachments are utilized, retainer clips shall be provided on each clamp.
Concrete Slabs Where Piping Revisions are Required and approved After slabs are Poured	Piping 3" and smaller may be supported at intermediate points by "Phillips", Hiltie, or other approved 3/4" expansion bolts and shields, provided main supports are welded to structural steel and such main supports are not less than 20 feet on centers. Intermediate supports for piping 4" and larger shall be attached to concrete beams or columns by means of 4" x 4" x 3/8" thick clip knee angles with 3/4" expansion bolt in shear (horizontal) & supporting rod at 90 from anchor bolt.

2.8 SLEEVES AND ESCUTCHEONS

A. General

1. *Provide sleeves for each pipe passing through walls,* partitions, floors, and roofs.

B. Sleeve Materials

Type Designation	
1	No. 22 USSG galvanized steel.
2	Standard weight galvanized steel pipe.

C. Sleeve Sizes

1. Floors and required fire rated partitions - ½" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

2. Partitions not fire rated - 1-1/2" maximum clearance between outside of pipe (or insulation on insulated pipes) and inside of sleeve.

D. Sleeve Lengths

Walls & Partitions	Equal to depth of construction and terminated flush with finished surfaces.

E. Sleeve Caulking & Packing

Type Designation	Caulking & Packing Requirements
1.	Space between pipe or pipe covering and sleeve shall be caulked with an incombustible permanently plastic, waterproof non-staining smooth appearance or pack with mineral wool or other equally approved f resistive material to within ½" c both wall faces and provide caulking compound as per above.

F. Sleeve Application

Sleeve Type Thru Required Fire Rated Construction	Sleeve Type Thru Non-Fire Rated Construction	Location	Sleeve Caulking & Packing Type Designation	Sleeve Caulking & Packing Type Thru Fire Rated Construction
2	1, 2	Interior walls, partitions & floors.	A	A

G. Escutcheons

1. Provide escutcheons on all exposed piping passing through walls, floors, partitions and ceilings, except provide close fitting metal escutcheons on both sides of piping (whether exposed or not) through required fire rated walls, floors, partitions and ceilings.

2. Escutcheons shall be held in place by internal spring tension or set screws.

H. Application

Location	
Finished spaces	Anodized aluminum, chrome plated brass.
Unfinished spaces: Excluding mechanical equipment rooms.	Plain brass, cast iron.

2.9 DRIP PANS

A. Examine the drawings and in cooperation with the Electrical Trade confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric motors and controllers, switchboards, panelboards, or similar equipment. Piping is not permitted in Electric Equipment, Transformer, Switch Gear, Telephone Gear Rooms.

B. Where the installation of piping does not comply with the requirements of foregoing paragraph, where feasible the piping shall be relocated.

C. Furnish gutters as follows:

1. Provide and erect a gutter of 16 ounce cold rolled copper or 18 gauge galvanized steel, under every pipe which is within 2'-0" from a vertical line to any motor, electrical controllers, switchboards, panelboards, or the like.

2. Each gutter shall be reinforced, rimmed, soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining. Provide a 3/4" drain, with valve as directed, to nearest floor drain or slop sink, as approved.

3. In lieu of such separate gutters, a continuous protecting sheet of similar construction adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

2.10 THERMOMETERS AND GAUGES

A. Thermometers

1. Provide thermometers in accordance with the following schedule and as shown on the plans, thermometers shall be 4-1/2" dial adjustable angel type, non-toxic vapor actuated, suitable for potable water use, immersion bulb and brass separable socket, cast aluminum case, white background black markings face. H.O. Trerice series V80342 or V80742 or as approved. Install in oversize pipe tee and nipple.

Thermometer Location	Temperature Range
Hot water outlet of water heaters	30° to 240° F.
Cold water inlet to water heaters	0° to 100° F.

B. Gauges

1. Provide pressure gauges in accordance with the following schedule and as shown on the plans.

2. Gauges shall have a 4-1/2" diameter dial, white coated with black figures and graduations, cast iron case with flat friction fit rings. Gauges shall be Ashcroft No. 1010 or other approved. Shutoff cock Ashcroft No. 1092, or other approved, shall be provided between gauge and piping to permit gauge removal while system is under pressure.

Gauge Location	Pressure Range
Cold water supply to cooling towers	0 - 150 p.s.i.

2.11 STRAINERS

A. Provide strainers on the upstream or inlet side of each automatic temperature and/or pressure regulating valve and/or automatically controlled open-close device, either snap-acting or modulating, and in systems handling liquids, gases and/or steam.

B. Except where specifically noted on the drawings to the contrary, or where local codes dictate to the contrary, provide "Y" type strainers, full pipe size, fitted with blowoff gate valves of the same size as the blowoff plug thread.

C. Strainer Basket Screens: Brass, except as otherwise specified, perforations as follows:

System or Service	Size of Each Perforation	No. of Perforations per Square Inch
Steam Gases	.020 inch	625
Water	.033 inch	324

D. Provide strainer bodies of the same material as scheduled for valves.

2.12 VALVES

A. The valve schedule on the drawing indicates the particular valve desired at the various locations indicated. Corresponding valves as made by approved manufacturers may be submitted for approval.

B. Ball valves may be used on 2" or less in size only if listed in valve schedule chart. Valves shall be two peice full-port brass and rated for 600 psi with maximum drop of 1 psi through valve.

C. All valves shall have manufacturer name and pressure rating cast or stamped thereon. All valves shall be rated for system pressure they are used for.

D. Drain valves (at low points): 3/4" with male thread for hose connections.

E. Furnish one manufacturer's guarantee for all valves.

F. Branch pressure reducing valves:

1. Shall maintain a constant downstream pressure (plus or minus 3 PSI) regardless of changing inlet pressures and/or flow rates. All flow conditions from zero to full flow are to be handled in a stable manner. The valve shall close drop tight when the downstream pressure rises to the setting of the spring. No pressure "creep" or leak can be tolerated. Valve body and cover shall be of an all bronze construction. The trim shall be 416 stainless steel. The valve shall contain an integral chrome nickel stainless steel strainer. All repairs shall be possible without removing the valve body from the line. The valve body shall be constructed of NPT union tail pieces at the inlet and outlet of the valve. The valve shall be similar in all respects to Cla-Val Co. 990 pressure reducing valve as manufactured by Cla-Val Co.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping before installation.

3.2 INSTALLATION

A. Disinfecting of Water System

1. Before being placed in service, all new domestic water mains and valves shall be cleaned, flushed and disinfected by the Contractor in strict conformance with the latest revised edition of American Water Works Association Standard C 601 for disinfecting water mains. The Contractor shall furnish all labor, materials and equipment required for disinfecting the water mains, including water, making taps in the main to develop flushing velocities and applying chlorinating agent, chlorine or chlorine bearing compounds, equipment for applying chlorinating agent and furnishing and installing taps for taking samples for bacteriological examination.

2. The Contractor shall take the required water samples for bacteriological examination and shall have an approved laboratory make the routine bacteriological examination of the samples of water. Copies of test results shall be submitted to the Architect.

3. The Contractor shall also furnish means for disposal of the water used in disinfecting and flushing the water mains. The water shall be wasted in such a manner to eliminate possibility of drainage to roadways, adjacent property, and contamination of water supply.

4. The Contractor may combine the hydrostatic test and the disinfection as long as the pipe line is completely flushed clean first.

END OF SECTION

SECTION 15440 - PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. In describing each piece of equipment, a manufacturer is usually named to give the quality of the items specified. Other manufacturers that agree with these specifications may be submitted for approval.

1.2 RELATED WORK

A. Section 15405 - Basic Materials, Methods and Requirements (Plumbing)

B. Section 15410 - Plumbing Piping

1.3 *REFERENCES*

A. See Section 15405.

1.4 *QUALITY ASSURANCE*

A. Company specializing in equipment of type specified for at least five years.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 SHOCK ABSORBERS

A. Provide shock absorbers where required and immediately adjacent to all pieces of equipment wherein quick closing valves are installed, including all equipment with solenoid valves such as but not limited to dish washers, pot washers, etc. Shock absorbers shall be J.R. Smith "Hydrotrol" 5000 Series or other approved. Size of shock absorbers shall be as recommended by the manufacturer whose product is used.

2.2 HOSE BIBBS

A. Provide and install where indicated, Chicago Faucet Co. No.-7T or other approved, Hose Bibb. Finish shall be rough brass in mechanical rooms with No E27 vacuum breaker 3/4" size.

B. Finished Areas: Chicago Faucet Co. No. 387 with No E27 vacuum breakers polished chrome plated finish, 3/4" size, lock shield cap, removable tee handle.

2.3 PLUMBING FIXTURES

A. General

1. All plumbing fixtures and trim shall be of the low consumption design type and shall comply with the latest N.Y.S. and N.Y.C. Water Conservation requirements of local law 28/89.

2. All fixtures provided for the disabled shall meet the latest A.D.A. Guidelines and requirements.

3. Fixtures shall be free from imperfections, true as to line, angles, curves, and color; smooth, watertight, and practically noiseless in operation.

4. All fittings, escutcheons, faucets, traps, exposed piping, etc., shall be brass, chrome-plated over nickel plate with polished finish. Any hanger nuts visible shall likewise be chrome-plated over nickel plate.

5. Before roughing work is started, submit to the Architect complete figured drawings and cuts of each and all of the plumbing fixtures, fittings, trimmings, etc., and trim samples, and secure his approval before proceeding with the installation of any work. These drawings shall show accurately the locations of all plumbing fixtures.

6. Provide all hangers, supports, brackets, etc., for the proper installation of the lavatories, sinks, etc., requiring support. Such supports shall be in accordance with the recommendations of the manufacturers of the fixtures and if built in to partitions or walls shall be set as the wall progresses.

7. All fixtures, specified to be of vitreous ware shall be fired vitreous china ware of the best quality, non-absorbent and burned so that the whole mass is thoroughly and vitrified, producing a material white in color, which when fractured will show a homogeneous mass, close grained and free from pores. The glazed and vitreous china fixtures shall be white, thoroughly fused and united to the body, without discoloration, chips, or flaws and shall be free from craze. Warped or otherwise imperfect fixtures will not be accepted.

8. The figure numbers specified are used as identification of the types, quality and features desired. Fixtures of other approved manufacturers may be submitted provided they meet fully in every respect with the fixtures specified. See schedule on the drawings for fixtures and trim.

B. Fixture Supports

1. Support all of the hereinbefore specified fixtures securely in a neat workmanlike manner on approved carriers or supports. The method of support for each fixture shall be as listed hereinafter. Josam numbers have been used to designate the type and quality of equipment desired; equivalent supports may be submitted for approval.

2. Support water closets on Josam 12000 or 14000 Series Chair fixture carriers or supports for water closets. The carriers or support shall include an adjustable extension with gasket, studs, hardware and chrome plate cap nuts necessary to secure the fixture to the support and shall be fitted with buttress foot, bolted to the floor, so carrier will not depend on wall construction for support.

C. Lavatories not in counters shall be generally supported on Josam 17100 Series concealed chair carrier, single or double as required, with block base foot with rectangular steel uprights support bolted to floor, adjustable alignment truss. Concealed arms shall be provided with leveling screws and locking device, and shall be designed to receive threaded escutcheons. Slab type lavatories shall be furnished with extra heavy, cast brass chrome plated threaded escutcheon between the fixture and the wall. The escutcheon shall be screwed on the adjustable sleeve or arm.

D. Urinals shall generally be supported on Josam-17800 Series chair carrier with block base supports bolted to floor, top plate for supporting concealed fixture hanger and through bolts, lower plate for supporting bearing bolts to keep lower part of fixture free of wall, rectangular steel pipe uprights, adjustable sleeves, and adjustable alignment truss.

E. All wall hung fixtures shall be made up tight to the wall, any spaces on voids due to the unevenness of the wall shall be filled in with approved grouting.

F. Flush valves shall be Sloan Valve Co. as specified or equivalent models as manufactured by Coyne and Delaney Co. White metal handles shall contain a minimum of 20% nickel in the composition of the alloy.

G. This Contractor shall be responsible for protecting against injury form the building materials, acids, tools and equipment, all plumbing included in these specifications.

H. All trim, faucets, flush valves, etc. shall have bright chrome finish, unless otherwise specified.

I. All stainless steel fixtures, electric water coolers (drinking fountains) to be satin finish stainless steel, unless otherwise specified.

J. All fixtures are to be provided with flow controls, to conserve water. All fixtures are to have individual stops.

K. All trim (faucets) for public toilets provided are to be of the metering type.

2.4 DOMESTIC WATER HEATERS

A. Listed below are the specifications for each type of water heater. The schedule on the drawings will indicate the model number, characteristics, size and locations.

B. Storage - Electric

1. Furnish and install where shown on the plans factory packaged electric storage water heater as manufactured by the Patterson-Kelley Company or equal. Provide deduct alternate for reuse of existing 26th floor heaters.

2. Storage section - Construction shall be in accordance with the ASME Code for a minimum working pressure of 150 psig. Insurance Company Certificates shall be furnished. The storage section shall have a shell lining of G-8 Pre-Krete and non-ferrous shell fittings.

3. Support Skids - The bottom of the storage section shall be supported from the floor by means of integrally welded support skids. No other support will be needed. Suitable steel lifting lugs are to be welded to the shell. Support skirt for vertical units.

4. Insulation - The storage section shall be factory insulated using 1 ½" thick fiberglass-type insulation and covered with heavy gauge anodic zinc coated steel metal and finished with hammertone synthetic enamel. As per 90-75 ASHRAE code.

5. Trim - The Storage section trim shall include an ASME pressure relief valve, a 3 ½" dial thermometer, range 20° to 240° F. and a 3 ½" dial pressure gauge, range 0 to 300 psig.

6. Recovery Section - Shall be electric and shall be completely factory assembled, wired and tested for operation.

7. The recovery section shall include a 14-gauge sheet metal enclosure complete with hinged door and safety interlock to prevent opening of the door without interrupting the power, copper bus bars and lugs for distribution of power, fuses on each load line, magnetic contactors, thermostat with number of steps as listed on the drawings, and a transformer to provide control circuit power at 120 volts. The distribution of power to the elements shall be made through rigid conduit. No circuit shall have in excess of 48 amperes.

8. High Limit Control - An additional thermostatic control shall be factory installed and be of the manual reset type. The purpose of this control will be to disconnect all ungrounded conductors to the heating elements in the event of an over-temperature condition in the storage section. (Re: 1971 National Electrical Code, Art. #422.)

9. Immersion Elements - The recovery section shall include one or more electrical immersion element to obtain the rated KW capacity. The watt density of the elements shall not exceed 50 watts per square inch and each blade shall be copper sheathed and be assembled into the tube sheet in such a way that field replacement of any single blade can be accomplished at the job site.

10. Each electrical immersion heating element shall use a 150# tube sheet and be copper lined on the face contacting the water. Tinned, plated, or brushed-on coating will not be acceptable in lieu of the copper lining.

11. The heating element shall also have a full copper support disc and this disc shall be supported by a non-ferrous bar, if the heating blades extend into the tank more than 42 inches.

12. U.L. Approval - Unit shall be Underwriter's Laboratories listed under BDJS, and shall bear the Underwriters' Label.

C. Electric Hot Water Heaters

1. Provide hot water heaters, where indicated on the drawings. Units shall be Lochinvar, Energy Saver, model number and capacities as scheduled on drawings. Approved equal will be accepted.

2. Heaters shall be electric, listed by Underwriters Laboratories.

3. Tanks shall be factory fired with glass lining rated at 150 psi working pressure and equipped with extruded high density magnesium modes. Electric heating elements shall contain zinc plate copper sheath.

4. The controls shall include a thermostat with each element and a high temperature cutoff. The jacket shall provide full size control compartments for performance of service and maintenance through front panel openings, and enclose the tank with fiberglass insulation. Tank shall be equipped with inlet and outlet connections and opening for relief valve, and meet 90A-80 ASHRAE.

5. Combination temperature and pressure relief valve piped to spill over safe waste. Provide control valve on inlet and outlet of heater.

2.5 SUCTION TANK STEEL

A. A steel tank size and capacity as schedules on the plans. Tank divided into two equal compartments. Sides and bottoms shall be 3/8" Class "A" steel plate. Sides flanged over 3" all around top for stiffness and drilled for bolting cover with ½" bolts on 6" centers. All corners to be butted and welded full on the inside, bottom plate to extend 3" beyond sides and end of tank and flange up to form a gutter. Tank braced on the inside at top with 4" - 5.4# channels in each compartment, welded solid to sides of tank and flush with top; also four diagonal corner braces in each compartment of 3" x 3" x 3/8" angles, 3'-0" long, set on a 45° angle and welded to end and side of tank and partition, flush with top at heel of 4" channel. Partition and ends of tank braced vertically with 8" - 11.5# channels on approximately 24" centers. Channels welded at top and bottom at heel and toe for a distance of 12" and tack welded between heel and toe on 12" centers. Tank furnished with outlets of heavy forge steel welding flanges, with female threads. Tank opening shall be screened where necessary to prevent entry of insects.

1. Cover: Cover 3/16" plate, bolted to top of tank with ½" bolts on 6" centers. Provide in cover, one 24" x 24" access door in each compartment.

2. Ladder: Provide heavy gauge aluminum ladders inside each compartment and one galvanized ladder on the outside with goose neck and made of 2" x ½" stringers with 3/4" rungs on 12" centers.

3. Dunnage Beams: Tank supported on minimum 12" WF steel dunnage set loose, under tank. Size as required by spacing and storage capacity.

4. Painting: Tank and beams shall be given one coat of bituminous applied cold in the shop, on the inside and outside, before shipment. Paint in the field with one coat of bituminous solution applied cold and one coat of bituminous enamel applied hot on the inside of tank, including underside of cover. On the outside paint one coat of bituminous solution applied cold, including beams. Paint shall be as manufactured by Koppers, or other approved.

C. Provide in each compartment of suction tank

1. Strainers: Bronze strainer on each discharge water connection to each tank compartment.

2. Drain Valve: Drain valve for each tank compartment.

3. All piping connections inside tank shall be brass pipe.

4. Overflow: Piped overflow for each tank compartment, galvanized steel pipe.

5. Vent: Piped vent for each tank compartment, with insect screen.

6. Float Valve: One each tank compartment fill line, Cla-Val Co. No. 427G-01HI all bronze with hush tube, vertical bar level, stop collars and guides. Provide a gate valve before each float and safety shut off valve.

7. Safety Solenoid Shut-Off Valve: On each tank fill line, electric or pneumatic safety shutoff valve. Valve to be actuated by tank high water alarm and shall shut down water supply to tank. Cla-Val Co. 136DG-01AHI.

2.6 ALARMS FOR SUCTION TANK

A. Alarms: High and low water alarms, electrode type, high water alarms to actuate safety shutoff valve.

1. In each compartment of the suction tank, provide cast iron flanges electrode holders with wire suspension stainless steel shielded electrodes. There shall be in each compartment one electrode for ground.

2. At the tank location, provide an electrode relay panel in NEMA type 1 wall mounting cabinet containing the following:-

   a. (1) Electrode relay for low water alarm.

   b. (1) Electrode relay for high water alarm.

3. All electrode relays shall operate on 120 volt primaries and not less than 250 volt secondaries. Power supply for alarms shall be from a source other than that supplied for pump control.

4. Provide one alarm panel enclosed in a NEMA Type 1 dropproof, formed sheet steel floor mounting cabinet designed for installation with its back against the wall. All components, wiring and operating handles shall be accessible from the front and shall contain for each alarm circuit one 3214 indicating light, one alarm relay, one bell silencing relay, on bell silencing pushbutton. One common 4 inch, 120 volt bell shall be provided for all alarm, each alarm system shall be provided for all alarm, each alarm system shall be provided with the following:-

   a. High Water - Suction Tank.

   b. Low Water - Suction Tank.

5. Provide bakelite nameplates designating purpose of each part. Provide terminal blocks properly labeled for all incoming and outgoing pilot and alarm connections. Assure that a complete low resistance ground is provided between the electrode relays and the water in the tank. The ground electrode relays and the water in the tank. The ground electrodes shall be connected to a copper cold water pipe near the tank and the ground terminals on the electrode relay panels will be connected to a cold water pipe.

2.7 DRAINS

A. The drain schedule on the drawings indicates the particular drain desired at the various locations indicated. The drains selected are representative of the quality, design and finish desired. Drains of other manufacturers may be submitted provided they meet fully in every respect (such as materials, weight open areas, clamping features, grate surface and finish, etc.) the characteristics and quality of the drain specified.

B. All drains shall include adjustable clamping collar device where membrane, flashing, or other waterproof floors or decks occur.

C. All drains shall include suitable extension collars, sump receivers, under deck clamps, as required to suit roof, floor or deck construction.

D. On all areas requiring flashing, provide flashing extending at least 12" beyond drainage flange and connections made water tight.

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 INSTALLATION

A. Install as per Section 15405 and 15991.

3.3 SCHEDULE

A. As described on drawings or in Products.

END OF SECTION

SECTION 15445 - PLUMBING PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. In describing each piece of equipment, a manufacturer is usually named to give the quality of the items specified. Other manufacturers that agree with these specifications may be submitted for approval.

1.2 RELATED WORK

A. Basic Materials, Methods and Requirements (Plumbing)

B. Plumbing Fixtures & Equipment

C. Plumbing Piping

1.3 QUALITY ASSURANCE

A. Company specializing in equipment of type specified for at least five years.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 SUMP PUMPS

A. Provide where indicated on plans, sump pump as described in these specifications.

B. Discharge piping up to the gravity drain on all sumps shall be galvanized steel with screwed drainage pattern fittings.

C. All equipment piping electrical wiring valves, etc., should be coordinated to be clear of operation and maintenance of pumps.

D. See schedule on the drawings for pump model no's. and characteristics.

E. Sump Pump Submersible

1. The electric submersible sump pump(s) construction materials shall be (cast iron, bronze fitted) (all bronze). The pump casing shall be cast with smooth water passages. The impeller shall be bronze, hydraulically and dynamically balanced for smooth and quiet operation.

2. Pump(s) shall be furnished with integrally mounted, water tight float switch. The direct acting single pole switch shall be mounted directly on the pump housing (single phase motors only).

F. Pump shall be provided with power cable.

2.2 DOMESTIC WATER CONSTANT PRESSURE BOOSTER SYSTEM

A. Provide in location as indicated on the drawings a Peerless Pump Co. duplex pumping system.

B. All items listed under Domestic Water Pumps shall be included in this system.

C. Each pump discharge line shall include a pilot operated diaphragm type combination pressure regulating and non-slam check valve, complete with opening speed control, stainless steel cover bolting and fully fused epoxy coating inside and out. Regulating valves shall be selected for a maximum of 5 PSIG pressure drop at full pump capacity. Main and auxiliary pressure regulating valves shall be used in parallel where required for accurate low flow pressure control.

D. Provide a remote precharged, diaphragm type, hydropneumatic tank, ASME code construction; the location, size and working pressure shall be as indicated on the plans. The tank shall have a minimum 1-1/4" system connection (located on the bottom), 1/4" vent and air charging valve. The tank shall be piped with isolation and hose bibb drain valves. It shall have a minimum useful storage volume of 30% with an operating pressure range of 30 to 50 PSIG. Provide a pressure transmitter at the tank, furnished by the pump system manufacturer. The transmitter shall be a Rosemount 1151GP heavy duty industrial grade with a 2000 PSI over pressurization rating.

E. Vertical Multi-Stage Diffuser Pumps (Type THV)

1. Pumps shall be vertical multi-stage diffuser type with cast iron casing and ANSI flanges. Pumps shall have bronze impellers 416 stainless steel shaft and 416 stainless steel shaft sleeves (hardened to a minimum of 225 Brinnell) and minimum of 5 rings of graphite impregnated packing. Each pump shall be provided with a flexible coupling and coupling guards. Pump thrust bearing shall be grease lubricated, the suction casing bearing bushing shall be self lubricated, sintered bronze. Vertical motors shall be of the solid shaft design.

F. Control Panel

1. The pump system control panel shall be a NEMA 1, multi-compartment enclosure mounted on the common system base, prewired with individual power feeds to each pump. It shall include a P.C. controllable controller with redundant failure circuitry and the following:

   a. Individual, door interlocked, fused disconnect switches for each pump.

   b. Magnetic across-the-line starters with three phase thermal overload protection and external reset buttons.

   c. 115 volt control circuit transformer, fused on both the primary and secondary sides with circuitry for automatic transfer of primary to active power feed.

   d. H-O-A selector switches.

   e. Running lights.

   f. Automatic and manual alternator with selector switch.

   g. Suction, system and individual pump discharge pressure gauges.

   h. Pressure and alarm switches.

   I. Set of necessary control and time delay relays and other accessory devices required to permit the system to operate in conformance with the specifications.

2. Alarms

   a. Low system pressure.

   b. Low suction pressure.

   c. Common audible alarm. Individual alarm lights and form "C" (1 N.O. and 1 N.C.) auxiliary alarm contacts for the above conditions.

3. All components shall be mounted on back panels.

4. All internal wiring shall be numbered corresponding to the wiring diagrams.

5. All connections to auxiliary contacts and control components, whether remote or panel mounted, shall be made to terminal strips.

6. Electric wiring shall be complete between the control panel, electric motors, and system mounted controls. The control panel shall bear the UL508 label of Underwriters Laboratories signifying that all work performed by the manufacturer is in compliance with the requirements of the Underwriters Laboratories. Approval of just the enclosure or electrical devices is unacceptable.

G. Operating Sequence

1. The electrical control system shall start and stop pumps as required by system demand. The lead pump shall run continuously with the ability to shutdown on no flow. Should the system demand exceed the capacity of the lead pump or should the lead pump fail to operate, the lag pump shall be started, in sequence, upon pressure drop. Upon drop in system flow, the pumps shall be stopped in reverse order. Equal pumps shall be automatically alternated.

2. In the event of a low system pressure condition, the pump shall be sequenced on and the alarm shall be activated. The pumps and alarm shall automatically reset when conditions return to normal.

3. In the event of a low suction level condition, the pumps shall be cut-off and alarm shall be activated. Pumps and alarm shall automatically reset when conditions return to normal.

4. In the event of a failure of a programmable controller ("P.C."), electronic pressure or flow sensor, a failure circuit shall activate redundant electromechanical controls and alarm and the system shall continue to operate in full automatic sequence.

5. All start/stop and alarm set points shall be field adjustable. Activation of all start-stop and alarm functions shall follow field adjustable time delays.

2.3 DOMESTIC WATER TRANSFER PUMP SYSTEM

A. Provide in location as indicated on the drawings a Peerless Pump Co. duplex pumping system.

B. All items listed under Domestic Water Pumps shall be included in this system.

C. Each pump discharge line shall include a non-slam check valve.

D. Vertical Multi-Stage Diffuser Pumps (Type THV)

1. Pumps shall be vertical multi-stage diffuser type with cast iron casing and ANSI flanges. Pumps shall have bronze impellers 416 stainless steel shaft and 416 stainless steel shaft sleeves (hardened to a minimum of 225 Brinnell) and minimum of 5 rings of graphite impregnated packing. Each pump shall be provided with a flexible coupling and coupling guards. Pump thrust bearing shall be grease lubricated, the suction casing bearing bushing shall be self lubricated, sintered bronze. Vertical motors shall be of the solid shaft design.

E. Control Panel

1. The pump system control panel shall be a NEMA 1, multi-compartment enclosure mounted on the common system base, prewired with individual power feeds to each pump. It shall include a P.C. controllable controller with redundant failure circuitry and the following:

a. Individual, door interlocked, fused disconnect switches for each pump.

b. Magnetic across-the-line starters with three phase thermal overload protection and external reset buttons.

c. 115 volt control circuit transformer, fused on both the primary and secondary sides with circuitry for automatic transfer of primary to active power feed.

d. On-off selector switches.

e. Running lights.

f. Pump selector switch.

g. Suction, system and individual pump discharge pressure gauges.

h. Pressure and alarm switches.

I. Set of necessary control and time delay relays and other accessory devices required to permit the system to operate in conformance with the specifications.

2. Alarms

a. Low system pressure.

b. Low suction level.

c. Common audible alarm. Individual alarm lights and form "C" (1 N.O. and 1 N.C.) auxiliary alarm contacts for the above conditions.

3. All components shall be mounted on back panels.

4. All internal wiring shall be numbered corresponding to the wiring diagrams.

5. All connections to auxiliary contacts and control components, whether remote or panel mounted, shall be made to terminal strips.

6. Electric wiring shall be complete between the control panel, electric motors, and system mounted controls. The control panel shall bear the UL508 label of Underwriters Laboratories signifying that all work performed by the manufacturer is in compliance with the requirements of the Underwriters Laboratories. Approval of just the enclosure or electrical devices is unacceptable.

F. Operating Sequence

1. The pumps shall be manually operated.

2. In the event of a high system pressure the pumps shall shut down and activate an alarm. Manual reset is required to return the pump to restart the pump.

3. In the event of a low suction level condition, the pumps shall be cut-off and alarm shall be activated. Pumps and alarm shall automatically reset when conditions return to normal.

4. In the event of a failure of a programmable controller ("P.C."), electronic pressure or flow sensor, a failure circuit shall activate redundant electromechanical controls and alarm and the system shall continue to operate in full automatic sequence.

5. All start/stop and alarm set points shall be field adjustable. Activation of all start-stop and alarm functions shall follow field adjustable time delays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as per Section 15405.

B. All pumps shall be hydrostatically tested, prior to shipment, the pump and motor and control panel shall be thoroughly shop tested by the manufacturer. A characteristic curve of pump performance from the test results shall be drawn and furnished to the Architect and Engineer.

3.2 SCHEDULE

A. As described on drawings or in Products.

END OF SECTION

SECTION 15450 - INSULATION FOR PLUMBING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Insulation for piping, and equipment as described.

1.2 RELATED WORK

A. Section Basic Materials, Methods and Requirements (Plumbing).

B. Section Painting: Painting insulation jackets.

1.3 REFERENCES

A. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

B. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E84 - Surface Burning Characteristics of Building Materials.

D. NFPA 255 - Surface Burning Characteristics of Building Materials.

E. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in insulation application with three years minimum experience.

B. Insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E.84, NFPA 255 or UL 723 not exceeding:

Flame Spread	25
Smoke Developed	50

Accessories such as adhesives, mastics, cements, and tapes for fittings shall have the same component rating as listed above. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facings to impart flame and smoke-safety shall be permanent. The use of watersoluble treatments is prohibited.

C. Adhesives and coatings shall be as manufactured by Insulcoustic or Benjamin Foster as follows:

	Insulcoustic	Benjamin-Foster
Vapor Barrier Adhesive	225	82-07
Vapor Barrier Coating	501	30-35
Lagging Adhesive	102	30-36
Insulation Adhesive	225	85-20
Glass Cloth Adhesive	225	85-20
Weatherproofing Mastic	VI-AC	GPM

Asbestos shall not be used in the manufacture of insulation products.

D. Where insulation is specified for piping, insulate similarly all connection, vents, drains, and any piping connected to system subject to heat loss or gain.

E. Asbestos shall not be used in the manufacture of insulation products.

F. ARMAFLEX insulation shall not be utilized or approved for field applied or factory installed installations on copper piping and fittings.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, list of materials and thickness for each service, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 INSULATION FOR PIPING & EQUIPMENT

A. Piping and equipment shall be insulated in accordance with the following schedule:

Service	Type # and Thickness	Notes
Domestic hot water & hot water circulation mains, risers & branches.	½" Type P-3 Local branch runouts to main. (Not to exceed 12 ft.) ½" & 3/4" size maximum 1" Type P-3 1" to 6" in size. 1½" Type P-3 8" and larger in size	
Domestic cold water mains, risers, branches & pump discharge piping. All piping on factory packaged pumps.	½" Type P-2	
Water heaters		Factory preinsulated heaters acceptable as specified.
Horizontal waste drain lines from floor or funnel drains in Mechanical Equipment Rooms to point of connection to vertical stack.	1" Type P-2	

B. Type P-2 Glass Fiber for Anti-Sweat Insulation

1. Insulation shall be glass fiber with a maximum K factor of .24 at 75 degrees F mean temperature with factory applied vapor barrier jacket. Exposed pipe insulation material must be the one piece type. Sectional type may be used for concealed piping.

2. Longitudinal lap and 3" wide vapor barrier joint seal strips shall be adhered neatly in place with vapor barrier adhesive.

3. Fittings and valves for pipe sizes smaller than 4" shall be insulated and finished with Insulating and Finishing Cement.

4. On pipe sizes 4" and larger use segments of the molded insulation or molded fiberglass fittings wired securely in place with copper clad wire. Flanges shall be insulated with sectional pipe insulation extending a minimum of 1" beyond the end of the bolts. Bolt area to be filled with mineral wool cement. Thickness of fitting, valve and flange insulation shall be same as adjoining pipe insulation. Concealed fitting, etc. may be insulated with 1 lb. fiberglass blanket wrapped firmly under compression and secured with copper clad wire.

5. All exposed piping shall be finished with a factory attached jacket, adhered with Armstrong Co. Clear Lap Seal Fire Resistant Adhesive.

C. P-3 Glass Fiber Pipe Insulation for Hot Pipes

1. Insulation shall be molded glass fiber with a maximum K factor of 0.24 at 75 degrees F mean temperature with factory applied jacket. Exposed pipe insulation material must be the one piece type. Sectional type may be used for concealed piping.

2. Longitudinal lap and 3" wide joint strips shall be secured with outward clinch staples on concealed piping and vapor barrier adhesive on exposed piping.

3. Fittings and valves for pipe sizes smaller than 4" shall be insulated and finished with Insulating and Finishing Cement. On pipe sizes 4" and larger use segments of the molded insulation or molded fiberglass fittings wired securely in place. Flanges shall be insulated with sectional pipe insulation extending a minimum of 1" beyond the end of the bolts. Bolt area to be filled with mineral wool cement. Thickness of fittings, valve and flange insulation shall be same as adjoining pipe insulation. Concealed fittings, etc. may be insulated with 1 lb. fiberglass blanket wrapped firmly under compression, 2 to 1 and secured with copper clad wire.

4. All exposed piping shall be finished with a factory attached jacket, adhered with Armstrong Co. Clear Lap Seal Fire Resistant Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install materials after piping has been tested and approved.

B. Clean surfaces for adhesives.

3.2 INSTALLATION

A. Insulation shall be applied on clean dry surfaces, after inspection and release for insulation application.

B. Insulation shall be continuous through wall and ceiling openings and sleeves.

C. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc. that are secured directly to cold surfaces shall be adequately insulated and vapor sealed to prevent condensation.

D. Direct contact between pipe and hanger shall be avoided.

E. Provide insulation protection as follows:

1. Between pipe and hanger or support provide rigid high density (minimum 9 lbs. per cu. ft. density) fiber glass insulation insert with factory applied jacket and metal protection shield or saddle inside hanger or support inserts, shield and saddles of sufficient length and strength to support weight of pipe without crushing insulation and shaped to fit not less than half the pipe circumference. Inserts of equal thickness of pipe insulation.

F. Vapor barriers where required, provided continuous and unbroken.

3.3 SCHEDULE

A. As described under products.

END OF SECTION

SECTION 15486 - FOUNDATIONS, VIBRATION ISOLATION, & SUPPORTS FOR RIGIDLY SUPPORTED EQUIPMENT (SEISMIC DESIGN)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Vibration control (seismic), restraints for rigidly supported equipment (seismic design).

1.2 RELATED WORK

A. Basic Materials, Methods and Requirements (Plumbing).

B. *Plumbing Piping.*

C. Plumbing Fixtures and Equipment.

1.3 QUALITY ASSURANCE

A. Applicator: Products provided by company specializing in vibration isolation with five years minimum experience.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, list of materials for each service, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

D. Vibration isolation equipment submittal drawings shall include the following information:

1. *Isolation mounting deflections.*

2. Spring diameters, compressed spring heights at rated load; solid spring heights, where steel spring isolation mountings are used.

3. Equipment operating speed.

4. Drawings, as required to show the number and location of seismic restraints for each equipment and specified details of restraints including anchor bolts for mountings and maximum load (static plus dynamic expected at each restraint or snubbing device including fastening devices for the seismic restraints which are capable of maintaining equipment in a captive position when subjected to external forces of 0.50g in any direction).

5. Drawings, as required, to show the number and location of seismic restraints for each equipment and specific details of restraints including anchor bolts for mountings and maximum load (static plus dynamic at each seismic restraint location).

PART 2 - PRODUCTS

2.1 VENDORS

A. The following vibration control vendors will be approved provided mounting systems are in strict accordance with the design intent as specified herein.

Mason Industries, Inc., Hollis, New York
Vibration Eliminator Co., Long Island City, N.Y.
Vibration Mountings & Controls Inc., Butler, N.J.
Consolidate Kinetics Co., Columbus, Ohio
Korfund Dynamics Co., Westbury, New York
Amber Booth, Houston, Texas

2.2 MOUNTING TYPE I-P
MOUNTING OF CENTRIFUGAL PUMPS - LOCATED ON SLAB ON GRADE (SLAB BEARING ON EARTH)

A. Each pump with its driving motor bolted and grouted to a minimum 10" thick concrete inertia base reinforced as required and isolation mounting pads between inertia base and concrete housekeeping pad.

B. Each concrete base (rectangular or "T" shape for horizontally split pumps) shall include supports and base elbows for the discharge and suction connections. Base elbows shall be bolted and grouted to the concrete foundation. The base shall incorporate seismic restrictions.

C. Isolation mounting pads of laminated cork and neoprene. Load distributing steel top plates provided where pump base does not provide uniform load surface.

2.3 MOUNTING OF PREFABRICATED WATER BOOSTER PUMP SYSTEMS

A. Prefabricated, packaged (prepiped) pump equipment with vibration isolation mountings to set on a 4" high concrete housekeeping pads.

2.4 VERTICAL WATER HEATERS MOUNTING TYPE VII-P

A. Floor mounted on pipe stand or angle iron frame stand, welded construction, equipped with steel bearing floor plates.

2.5 SUCTION TANKS MOUNTING TYPE VIII-P

A. Supported on dunnage beams - refer to tanks specification section for details.

2.6 SUPPORT OF PIPING PIPING IN AND ADJACENT TO EQUIPMENT ROOMS

A. The following water piping shall be resiliently supported:

1. All piping in equipment room.

2. Piping outside of equipment rooms within 50 feet of connected rotating equipment.

3. All other piping as described under Hangers Supports and Guides (Seismic Design) shall be rigidly supported and provided with approved seismic restraints to maintain the piping in a captive attitude without excessive motion. All piping conforming to the hanger rod spacing schedule as hereinbefore specified or as required to limit transmitted forces to the building structure to acceptable limits.

B. Resilient diagonal mounting or other approved devices shall be provided as required to limit piping motion due to equipment startup or shutdown, to a maximum of 1/8".

C. Water piping hanger rod isolators shall contain a steel spring in series with a 1/4" acoustical neoprene pad with a steel box retainer. The hanger rod isolator assembly shall be rigidly supported one end from the building structure. The installed hanger rod supported from the spring sub-assembly shall not contact the steel box retainer and clearances in the isolator design shall be capable of accepting a 15 degree misalignment in any direction from the vertical.

D. The steel spring element of the assembly shall be designed to have a minimum surge frequency of 340 HZ and a minimum deflection of 3/4".

E. Where supplementary steel is required to support piping, the supplementary steel shall be sized so that maximum deflection between supports does not exceed 0.8" and shall be resiliently supported from the building structure with mountings as described above. Supported piping from the supplementary steel shall be rigidly suspended or supported.

F. Where isolated water piping 8" and larger is supported directly below exposed steel beams, attachment to the beam shall be made by means of welded channel beam located directly under the web of the beam. For piping 6" and smaller, beam clamps may be used in lieu of welding subject to approval of the beam clamp selection.

G. All water piping hanger rod isolators shall be one of the following or as approved:

Type	Manufacturer
PC30	M.I.I.
VSHL	V.M.C.I.
TK	V.E.C.
VXPM	K.D.C.

H. Floor supported water piping shall be mounted on one of the following or as approved:

Type	Manufacturer
SLR	M.I.I.
AWR	V.M.C.I.
KW	V.E.C.

2.7 PIPING RISERS, ANCHORS, GUIDES, PUMP LINES

A. Pipe risers with guides, anchors and supports, pump discharge lines (horizontal and vertical), shall be isolated from the building structure, such that there shall be no direct contact of the piping and supports with the building structure. Provide isolation pads with load bearing steel plates and supports with isolation material.

B. Isolation pads and linings shall be one of the following or as approved:

Type	Manufacturer
W	M.I.I.
Shearflex	V.M.C.I.
200N	V.E.C.

C. Isolation pads shall not be loaded in excess of 40 PSI.

2.8 PIPING PENETRATIONS OF BUILDING SHAFTS, FLOOR SLABS, WALLS, PARTITIONS, ETC.

A. There shall be no direct contact of piping with shaft walls, floor slabs and/or partition. All voids around uninsulated piping shall be packed with caulking the full depth of the penetration.

B. Test equipment in service and demonstrate that the equipment performs the work intended for it and that it complies with the requirement of these specifications for such equipment.

2.9 RIGIDLY SUPPORTED EQUIPMENT

A. All rigidly supported equipment, i.e., hot water heaters, storage tanks, and the like, shall be provided with approved seismic control devices, as required, to prevent overturning or sliding.

B. Ceiling supported equipment, including piping shall be provided with approve seismic control devices to maintain the equipment in a captive attitude.

2.10 SEISMIC SNUBBER RESTRAINTS

A. All floor mounted and resiliently mounted equipment shall be provided with a minimum of four (4) all-direction seismic snubbers. These snubbers shall be double-acting and located as close as possible to vibration isolators to facilitate attachment to equipment base and building structure.

B. Snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials. The elastomeric materials shall be replaceable and a minimum 3/4" thick. Snubbers shall be manufactured with a minimum 1/4" clearance between equipment base mounted section and structure mounted section.

C. Snubber capacity at 3/8" deflection shall be three to four times load assigned to snubber group for equipment. Acceptable products are:

Type Z1011	M.I.I.
Type SR	V.M.C.I.
Type DADR	V.E.C.O.

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 GENERAL

A. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports, all as specified herein, or as shown on the drawings.

B. All rigidly or resiliently installed equipment, piping, etc., shall be capable of accepting seismic forces of 0.50g acting in any direction on the equipment center of gravity without permanent displacement of the equipment from the installed position.

C. All concrete foundations and supports (and required reinforcing and forms) will be furnished and installed by another trade. However, this trade shall furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports, and all required hanger bolts and other appurtenances necessary for the proper installation of his equipment. Although another trade will complete all concrete work, all such work shall be shown in detail on the shop drawings, prepared by this trade which drawings shall be submitted showing the complete details of all foundations including necessary concrete and steel work, vibration isolation devices, etc.

D. All floor-mounted equipment shall be erected on 4" high concrete pads over the complete floor area of the equipment, unless specified to the contrary herein. Wherever hereinafter vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted upon 4" high concrete pads unless specified to the contrary herein. These pads shall be integrally keyed to structural slab.

E. The vibration isolation systems shall be guaranteed to have the deflection indicated on the schedule on the drawings. Mounting sizes shall be determined by the mounting manufacturer, and the sizes shall be installed in accordance with the manufacturer's instructions.

F. The installed vibration isolation system for each floor or ceiling supported equipment shall have a maximum lateral motion under equipment start-up or shut down conditions of 1/4 inch. Motions in excess shall be restrained by approved spring type mountings.

G. All mounting systems including seismic restraints exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) to be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.

H. Where steel spring isolation systems are described in the following specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load versus deflection curve and have 50% excess capacity without becoming coil bound.

I. Each seismic restraint, snubbing device or isolation mounting incorporating seismic restraint shall be installed and/or adjusted to provide the minimum operating clearance in all directions to permit the operation of the equipment without objectional noise or vibration to any part of the building structure. The operating clearance for equipment seismic restraints shall not be greater than 1/4 inch.

J. Equipment seismic restraints or snubbing devices and vibration isolation systems mounting shall be the product of one manufacturer.

K. Vibration isolation equipment submittal drawings shall include the following information:

1. Isolation mounting deflections.

2. Spring diameters, compressed spring heights at rated load; solid spring heights, where steel spring isolation mountings are used.

3. Equipment operating speed.

4. Drawings, as required to show the number and location of seismic restraints for each equipment and specified details of restraints including anchor bolts for mountings and maximum load (static plus dynamic expected at each restraint or snubbing device including fastening devices for the seismic restraints which are capable of maintaining equipment in a captive position when subjected to external forces of 0.50g in any direction).

END OF SECTION

SECTION 15991 - TESTING OF SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Testing of all Plumbing systems.

1.2 RELATED WORK

A. Section 15405 - Basic Materials, Methods and Requirements (Plumbing)

B. Section 15410 - Plumbing Piping

C. Section 15440 - Plumbing Fixtures and Equipment

1.3 REFERENCES

A. See Section 15405.

1.4 QUALITY ASSURANCE

A. Five years experience in plumbing installations.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

PART 2 - PRODUCTS

A. Not applicable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 INSTALLATION

A. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests herein specified. Correct all defects appearing under test and repeat the tests until no defects are disclosed; leave the equipment clean and ready for use.

B. This Trade shall, during the progress of the work or upon its completion as ordered make such tests in the presence of the owner's representative Building Department Inspectors, and any other authorities having jurisdiction.

C. The Plumbing Trade shall provide all apparatus, temporary work or any other requirements necessary for such tests. He shall take all due precautions to prevent damage to the Building or its contents that may be incurred by such tests as he will be required to repair and make good, at his own expense, any damage caused.

D. Any defects or deficiencies discovered as a result of tests shall be immediately repaired and tests shall be repeated until the test requirements are fully complied with.

E. No caulking of pipe joints to remedy leaks will be permitted except where lead and oakum joints are used.

F. It shall be the responsibility of this contractor to keep records on all testing of systems.

G. The testing procedures listed are the minimum required, any jurisdictional codes that call for additional requirements shall naturally be done.

3.3 DOMESTIC WATER SYSTEMS

A. The domestic water supply systems shall be tested to a hydraulic pressure equal to 1-1/2" times the normal operating pressure before being enclosed and before non-conducting covering is applied. All leaks or defects indicated by tests shall be repaired or replaced with new material. Run test without a loss of pressure for a minimum of two hours.

B. All equipment shall be tested and adjusted where required to assure proper operation.

3.4 SANITARY, STORM DRAINAGE AND LAB WASTE SYSTEM

A. The entire sanitary waste, soil, drainage and vent system shall be tested. Each section of drainage and vent roughing piping tested shall have all openings tightly closed with screw plugs, or equal device and shall stand without loss of level for a period of four (4) hours when filled with water to produce at least a 10 foot head or its equivalent pressure at the section tested.

3.5 TESTING OF FIRE SAFETY SYSTEMS

A. This trade shall include in the base bid price sufficient man hours to conduct tests of fire safety systems. The trades shall jointly assign personnel to test the following

1. Electric

2. HVAC Fans and Dampers

3. Automatic Controls and Signals

4. Fire Suppression System (Sprinkler, Standpipe, Halon, etc.)

5. Fire Protective Alarm System

6. Smoke Evacuation Systems

B. This trade shall coordinate with other trades and jointly test all systems. When all systems are working properly, inform Owner in writing so that Owner's representative can witness.

END OF SECTION

SECTION 15996 - MISCELLANEOUS PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Equipment as described.

1.2 RELATED WORK

A. Section 15405 - Basic Materials, Methods and Requirements (Plumbing)

1.3 REFERENCES

A. See Section 15405.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in equipment of type specified.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Include product description, and locations.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

PART 2 - *PRODUCTS*

2.1 HWAT SELF-REGULATING TEMPERATURE MAINTENANCE FOR DOMESTIC HOT WATER PIPING

A. Provide complete system of UL listed (New York City M.E.A. and B.E.C. approved) self-regulating heaters and components applied to the domestic hot water piping to maintain the selected water temperature, HWAT plus, as manufactured by Raychem Corp. where indicated on plans.

B. The cable shall be specifically designed, manufactured, listed and approved for domestic hot water temperature maintenance.

C. The nominal water temperature shall be maintained at 125°F HWAT-Y2, 140°F HWAT-R2.

D. The heater shall consist of two (2) tinned-copper bus wires embedded in parallel in a self regulating polymer core especially designed for this application that varies its heat output all along its length, allowing the heater to maintain the water in the selected temperature range. The heater shall be covered by a cross-linked polyolefin dielectric jacket, polymer coated aluminum wrap and protected by a tinned copper braid and a color coded outer jacket. The cable shall terminate in a power connection box for each zone.

E. The specified system temperature shall be maintained using only one product, regardless of pipe size. The insulation schedule shall be the same regardless of the design system temperature. Temperatures shall be maintained with straight runs of heating cable on the pipe.

F. The heater shall operate on 208 volt, 1 phase electric power supply.

G. Components shall be UL listed as part of the system and approved for installation under the insulation to minimize the need for access doors. Components shall be RayClic, quick connect type rated for 30 amps, power connections shall be factory terminated and supplied with 10' of cold leads. Enclosures shall be re-enterable to allow for testing, NEMA 6P (watertight, submersible) to prevent water ingress and corrosion. Installation shall require only standard hand tools and shall be completed without stripping of the bus wires, use of crimps, silicone sealant or terminal blocks. Furnish all power connections, tees, splices, end seals, fiberglass tape and electric traced labels, as required.

H. Insulate all hot water piping, whether heat traced or not. Do not use staples to secure the insulation. Insulate through floor penetrations or otherwise protect the cable from damage. Insulation over all tee's splices and end seals, after system testing, mark their location and install "Electric Traced" labels every ten feet. The insulation schedule shall be as follows:

	PIPE SIZE	FIBERGLASS INSULATION THICKNESS
*	½" - 1"	1"
**	1 1/4" - 2"	1 ½"
	2 ½" - 6"	2"

* For pipe sizes 1 1/4" and smaller, use insulation jacket 1/4" larger in diameter than normal to allow space for heater cable.

I. Plumbing Trade to provide and install HWAT system with all components and connect HWAT system to J-Box on wall, not more than 25' from end of each HWAT circuit. Electrical contractor to provide J-Box (on wall). All electrical work extensions required for a complete operating system from the junction boxes that will be provided by the electrical contractor will be the responsibility of this contractor. This contractor shall verify type and location of 30 ma trip ground fault breakers which power each circuit.

J. Installation of HWAT shall be performed after the hot water supply system has been successfully pressure tested and before the insulation is installed.

K. Unless otherwise noted on the plans, trace all hot water supply piping including drops to the fixtures, and horizontal pipe in chases behind the fixtures. Installation shall be in accordance with the manufacturer's recommendations, after all piping has been pressure tested.

L. Secure the heater to piping with cable ties or fiberglass tape.

M. Protect the heater from damage.

N. Apply "electric traced" signs to the outside of the thermal insulation.

O. Tests

1. Prior to shipment, subject all of the heater to inspection and a high-frequency spark test and all braided product to a dry dielectric test.

2. After installation and before and after installing the thermal insulation, subject heater to testing, using a 2500 VDC megger. Minimum insulation resistance shall be twenty (20) megohms regardless of length. The final megger test shall be performed after all walls and ceilings are in place. This test shall be witnessed by Construction Manager and the manufacturer's representative. Test results must be submitted to the manufactured on Form H54390 to activate the warranty.

P. As-built Drawings: Installer shall provide as-built diagrams of the tracing installation, which shall include locations of all power connections, end terminations, access test points, tee's, splices and circuit identification of breakers with their corresponding piping.

Q. The HWAT shall be warranted for a period of ten (10) years by the manufacturer.

2.2 LEAK DETECTION SYSTEM

Provide in locations as indicated on the drawings complete leak detection systems.

A. Suction Tank Rooms Leak Detection System

General: Furnish and install a complete fluid detection system, including electronic alarm and locating module, sensing cable, and all auxiliary equipment. The system shall simultaneously detect liquid at any point, sound an alarm. No metallic parts shall be exposed to the environment. System shall be UL listed FM approved. System shall be TraceTeck 3000 Longline System manufactured by Raychem Corporation, Menlo Park, California.

B. Components: Alarm and locator module TTB-FA able to monitor up to 2000 feet at sensing cable. Module shall include audible alarm, silencing button, output relay, digital readout, power indicator, alarm indicator, continuity LED's. Module shall continuously monitor the sensing cables. Unit power shall be 120 VAC with remote alarm contacts. The module enclosure shall be 16 gauge steel surface mounted enameled finish.

C. Installation

General: All TraceTeck system components shall be installed in accordance with manufacturer's installation instructions. TraceTecks system manufacturer shall and calibration of the system. Manufacturer shall provide a list of authorized service agents who provide annual service agreements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Not applicable.

3.2 INSTALLATION

A. Install as per Section 15405.

3.3 SCHEDULE

A. As described on drawings or in Products.

END OF SECTION

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DIVISION 16000

ELECTRICAL

INDEX

Article	Title	Page No.
SECTION 16050 - BASIC MATERIALS, METHODS AND REQUIREMENTS (ELECTRICAL)		
PART 1 - GENERAL		
1.1	Description	16050-1
1.1A	Contractor's Responsibility Regarding Utility Company Rebate Programs	16050-15
1.2	Quality Assurance	16050-16
1.3	Submittals	16050-18
1.4	Seismic	16050-21
1.5	Alternate Price Quotations	16050-31
1.6	Work Included	16050-31
1.7	Related Work	16050-31
1.8	References	16050-32
PART 2 - PRODUCTS		
2.1	Selection of Wiring Materials for Light and Power Circuitry and Distribution	16050-32
2.2	Requirements Governing Electric Work in Damp or Wet Locations within Building Confines	16050-34
2.3	Threaded Metallic Conduit	16050-36
2.4	Electric Metallic Tubing (Thin Wall Conduit)	16050-37
2.5	Wires for Light and Power Circuitry and Distribution	16050-37
2.6	Junction Boxes, Pull Boxes, Outlet Boxes and Wiring Troughs	16050-38
2.7	Wiring Devices	16050-43
2.8	Circuitry for Miscellaneous Low Voltage Systems	16050-47

Article	Title	Page No.
PART 3 - EXECUTION		
3.1	Identification and Tagging for Electric Equipment	16050-48
3.2	Fire-Stopping	16050-51
3.3	Limiting Noise Produced by Electrical Installation	16050-52
3.4	Mounting Heights	16050-53
3.5	Existing Electrical Work	16050-55
3.6	Supports	16050-55
3.7	Fastenings	16050-58
3.8	Locating and Routing Circuitry	16050-60
3.9	Installing Circuitry	16050-61
3.10	Installing Conduits and Raceways	16050-63
3.11	Pulling Wires Into Conduits and Raceways	16050-65
3.12	Splicing and Terminating the Conductors of Wires and Cables	16050-66
3.13	Fireproofing Wires and Cables	16050-68
3.14	Installing Junction, Pull and Outlet Boxes	16050-68
3.15	Installing Circuitry and Equipment in Hazardous Locations	16050-71
3.16	Installing Wiring Devices	16050-71
3.17	Installation of Circuitry for Miscellaneous Low Voltage Systems	16050-72
3.18	Installation of Seismic Restraints	16050-73
SECTION 16400 - SERVICE AND DISTRIBUTION (600 VOLTS AND BELOW)		
PART 1 - GENERAL		
1.1	Work Included	16400-1
1.2	Related Work	16400-1
1.3	References	16400-1
1.4	Quality Assurance	16400-1
1.5	Submittals	16400-1
PART 2 - PRODUCTS		
2.1	Main Switchboards for Light and Power	16400-1
2.2	Panels for Light and Power	16400-2
2.3	Individually Mounted Overcurrent and Switching Devices	16400-7
2.4	Selection of Overcurrent Protection and Switching for Light and Power Distribution (Program UNIV-SWF)	16400-8
2.5	Dry Type Transformers -- Secondary Voltage to Secondary Voltage	16400-18
2.6	Bus Duct	16400-19
2.7	Under Floor Duct	16400-20

Article	Title	Page No.
PART 3 - EXECUTION		
3.1	Secondary Electric Service	16400-20
3.2	Installation of Panelboards	16400-21
3.3	Installation of Dry Type Transformers	16400-21
3.4	Installation of Feeders	16400-21
3.5	Installation of Lighting and Appliance Branch Circuitry	16400-22
3.6	Grounding Requirements	16400-29
3.7	Electric Motor Driven Equipment in Mechanical Systems	16400-33
3.8	Process Control Systems	16400-37
3.9	Motor Control Circuitry	16400-37
SECTION 16500 - LIGHTING		
PART 1 - GENERAL		
1.1	Work Included	16500-1
1.2	Related Work	16500-1
1.3	Submittals	16500-1
1.4	Quality Assurance	16500-2
PART 2 - PRODUCTS		
2.1	Manufacturers	16500-3
2.2	Fixtures and Fixture Components	16500-3
2.3	Lamps	16500-10
2.4	Finishes	16500-10
2.5	Lighting Controls	16500-11
PART 3 - EXECUTION		
3.1	Installation	16500-11
3.2	Connections	16500-12
3.3	Field Quality Control	16500-12
3.4	Adjusting and Balancing	16500-12
SECTION 16600 - SPECIAL SYSTEMS		
PART 1 - GENERAL		
1.1	Work Included	16600-1
1.2	Related Work	16600-1
1.3	References	16600-1
1.4	Quality Assurance	16600-1
1.5	Submittals	16600-1

Article	Title	Page No.
PART 2 - PRODUCTS		
2.1	Emergency Electric Generating Sets -- Diesel Engine Driven	16600-2
2.2	Automatic Transfer Switches	16600-2
PART 3 - EXECUTION		
3.1	Certifications	16600-2
3.2	Installation of Emergency Generating Set	16600-2
3.3	Installation of Automatic Transfer Switches	16600-2
SECTION 16700 - COMMUNICATIONS		
PART 1 - GENERAL		
1.1	Work Included	16700-1
1.2	Related Work	16700-1
1.3	References	16700-1
1.4	Quality Assurance	16700-1
1.5	Submittals	16700-1
PART 2 - PRODUCTS		
2.1	Modifications to Existing Fire Protective Alarm System	16700-1
PART 3 - EXECUTION		
NOT INCLUDED		
SECURITY SYSTEM SPECIFICATION 11020		
AS FOLLOWS		

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SECTION 16050 - BASIC ELECTRICAL MATERIALS, METHODS AND REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. See General Conditions.

B. Basic Electrical Materials, Methods and Requirements applies to all sections of Division 16.

C. Codes, Permits and Inspections:

1. All work shall meet or exceed the latest requirements of all national, state, county, municipal, Port Authority of NY & NJ and other authorities exercising jurisdiction over electrical construction work and the project.

2. All required permits and inspection certificates shall be obtained, paid for, and made available at the completion of the work.

3. Equipment, material, layout and installation provided as part of the electrical work shall conform to the requirements of the Advisory Board of the Bureau of Electrical Control (Department of Buildings), the Mechanical Equipment Acceptance Division of the Building Department (MEA), the Board of Standards and Appeals (BSA), and other agencies having jurisdiction. Include as part of the electrical work all required filings and submissions for approval. Equipment furnished separate from - but installed as part of - the electrical work, which does not have all necessary approvals, shall not be installed until approvals are obtained by the parties furnishing the equipment.

4 The controlled inspection for certain portions of the work as called for in the New York City Building Code, Section C26-106.3 and Section C26-107.3 and the filing of all necessary reports for approval, Form TR-1, with the Building Department shall be included as part of the electric work. The name of the registered Professional Engineer who will be responsible for making the inspections on Form TR-1 shall be submitted for approval as soon as possible or within 90 days of the award of the contract.

5. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).

D. Guarantees and Certifications

1. All work shall be guaranteed to be free from defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.

2. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.

3. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.

4. Non-durable items such as electric lamps, shall be replaced up to the date of acceptance, such that they shall have had no more than 100 hours use prior to this date.

5. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of electrical equipment for which such certifications is required.

E. Definitions and Interpretations

1. As used in the drawings and specifications for electrical work, certain non-technical words shall be understood to have specific meanings as follows regardless of indications to the contrary in the General Conditions or other documents governing the electric work.

"Furnish" -- Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the electrical work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased items are free of all liens, claims or encumbrances.

"Install" -- Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the electrical work.

"Provide" -- "Furnish" and "install."

"New" -- Manufactured within the past two years and never before used.

2. Regardless of their usage in codes or other industry standards, certain words as used in the drawings or specifications for the electrical work, shall be understood to have the specific meanings ascribed to them in the following list:-

"Circuitry" -- Any electric work (not limited to light and power distribution) which consists of wires, cables, raceways, and/or specialty wiring method assemblies taken all together complete with associated junction boxes, pull boxes, outlet boxes, joints, couplings, splices and connections except where limited to a lesser meaning by specific description.

"Wiring" -- Same as Circuitry.

"Circuit" -- Any specific run of circuitry.

"Branch Circuit" -- Any light and power distribution system circuit which, at its load end, is directly connected to one or more electrical energy consuming items with no overcurrent protection devices interposed, other than (where required) those protecting the energy consuming items from overloading or overheating.

"Appliance Panel" -- Any panel, used in a light and power distribution system, containing only single pole and multipole branches rated in various sizes.

"Lighting Panel" -- Any panel used in a light and power distribution system, having all (or the majority) of its branches single pole and rated the same.

"Lighting and Appliance Branch Circuitry" -- All or any portion of branch circuits outgoing from a lighting or appliance panel.

"Feeder" -- Any item of light and power circuitry used in a distribution system which is not lighting and appliance branch circuitry.

"Main Feeder" -- Any feeder which, at its supply end, is connected through its own overcurrent protection (and switching) device, and none other, directly to a main service or a main service overcurrent protection (and switching) device.

"Branch Feeder" -- A feeder, other than a main feeder, which complies with the definition of a branch circuit.

"Submain Feeder" -- Any feeder which is neither a main feeder nor a branch feeder.

"Distribution Panel" -- Any panel, used in a light and power distribution system, containing only multi-pole branches and with all (or the majority) of its branches used for feeders supplying other panels.

"Power Panel" -- Same as distribution panel, except with all (or the majority) of its branches used for feeders which do not supply other panels.

"Motor Power Circuit" -- Any circuit which operates nominally at 100 volts or more, and which carries electrical input energy to a motor.

"Motor Control Circuit" (used in conjunction with a motor for which a magnetic starter is supplied) -- Any circuit (other than a motor power circuit), which operates nominally at 100 volts or more, and which carries current intended for directing or indicating the performance of a motor starter.

"Motor Control Circuit" (used in conjunction with a motor for which a manual starter is supplied) -- Any circuit containing an extension of power circuit wires, other than those constituting the direct connection between source of supply, starter and motor.

"Motor Control Actuating Device" -- Any device which performs a switching function in a motor control circuit (pushbuttons, automatic contacting devices, etc.).

"Motor Control Actuated Device" -- Any device which functions in response to voltage received from a motor control circuit (pilot lights, solenoids, etc.)

"Package Unit" -- An item of equipment having one or more motors or other electric energy consuming elements integrally factory mounted on a single base, complete with all associated control devices and interconnecting wiring.

"Low Voltage" -- Below 50 volts.

"Process Control System" -- An overall control and/or logging system of a low voltage, electronic or pneumatic type available as a fully installed "package" from specialty manufacturers (commonly referred to as a "Temperature Control System" or an "Automatic Control System" or a "Building Management System" where used in conjunction with air conditioning).

"Grade Slab" -- A building floor slab which is in contact with or directly over grade (earth).

"Building Confines" -- The extent of a building, as defined by the outside surfaces of its peripheral walls, the top surface of its roof, and the underside surface of its grade slab.

"Distribution Switch" -- Any switch used in a light and power system other than a tumbler, toggle or specialty switch in the "wiring device" category.

"Normal Electric Work Conditions" -- Locations within building confines which are neither damp, wet nor hazardous and which are not used for air handling.

"Underground" -- Subsurface and exterior to building foundations.

"At Underside of Grade Slab" -- Under a grade slab and integrated into it.

"Below Grade Slab" -- Under a grade slab but not integrated into it.

"Standard" (as applied to wiring devices) -- Not of a separately designated individual type.

"Raceway" -- Any pipe, duct, extended enclosure, or conduit (as specified for a particular system) which is used to contain wires, and which is of such nature as to require that the wires be installed by a "pulling in" procedure.

"Specialty Cast-in-Floor Raceway" -- Underfloor duct.

"Concealed" (as applied to circuitry) -- Covered completely by building materials, except for penetrations (by boxes and fittings) to a level flush with the surface as necessitated by functional or specified accessibility requirements.

"Exposed" (as applied to circuitry) -- Not covered in any way by building materials.
"Subject to Mechanical Damage" -- Exposed within seven feet of the floor in mechanical rooms, or other spaces where heavy items (over 100 pounds) are moved around or rigged as a common practice or as required for replacement purposes.

"Primary" (as applied to light and power distribution) -- Over 600 volts.

"Secondary" (as applied to light and power distribution) -- Under 600 volts.

"Assembly" -- A defined set of elements of electric work.

3. Where the word "conduit" is used without specific reference to type, it shall be understood to mean "raceway."

4. Reference to "U.L. (Materials Construction) Standards" shall mean the "Standards for Safety," published by Underwriters Laboratories, Inc. (Main Office: 333 Pfingsten Road, Northbrook, Illinois 60062).

5. Reference to "RLM Standards" shall mean the Standards published by the Registered Luminaire Manufacturers Institute (Main Office: P.O. Box 754, Meriden, Connecticut).

6. Reference to "CBM Specifications" shall mean the specifications published by the Certified Ballasts Manufacturers Association (Main Office: 2116 Keith Building, Cleveland, Ohio).

7. Reference to "NEMA Standards" shall mean the "Approved Standards" published by the National Electrical Manufacturers Association (Main Office: 2101 "L" Street, N.W., Washington, D.C. 20037).

8. Reference to "ANSI Standards" shall mean the standards published by the American National Standards Institute (Main Office: Twenty East Fortieth Street, New York, New York 10016).

9. Reference to "ICEA Standards" shall mean the standards published by the Insulated Cable Engineers Association (Main Office: 283 Valley Road, Montclair, New Jersey 07042).

10. Reference to "AEIC Specifications" shall mean the specifications published by the Association of Edison Illuminating Companies (Main Office: Fifty-one East Forty-second Street, New York, New York 10017).

11. Reference to "ASTM" specifications shall mean the specifications published by the American Society for Testing and Materials (Main Office: 1916 Race Street, Philadelphia, Pennsylvania 19103).

12. Items and installation methods as described in the drawings and specifications for electrical work are to be used only under normal electric work conditions as hereinafter described unless there are specific notations to the contrary.

13. Items and installation methods as described in the drawings and specifications for electrical work are to be used only at less than 600 volts unless there are specific notationsto the contrary.

14. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the drawings and specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the electrical work regardless of whether or not this instruction is explicitly stated.

15. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.

16. To the extent that they govern the basic work, the specifications also govern change order work if any.

17. No exclusion from or limitation in, the symbolism used on the drawings for electrical work or the language used in the specifications for electrical work shall be interpreted as a reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.

18. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall, therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings, but in conformity with the dimensions indicated on the final working drawings, field layouts and shop drawings of all trades. In particular, information as to the exact size, location and electrical connection points for mechanical equipment shall be derived by reference to HVAC and Plumbing documents.

19. Certain details appear on the drawings for electrical work which are specific with regard to the dimensioning and positioning of the work. These are intended only for general information purposes. They do not obviate field coordination for individual items of the indicated work.

20. Information as to general construction and architectural general construction and architectural features and finishes shall be derived from structural and architectural drawings and specifications only.

21. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

22. Ratings of devices, materials and equipment specified without reference to specific performance criteria shall be understood to be nominal or nameplate ratings established by means of industry standard procedures.

F. Separation of Work Between Trades

1. The specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that if affects the electric work.

2. In the absence of more detailed information, the list shall be taken as a specific instruction to the electrical trade to include the work assigned to it.

3. Indications that any trade is to perform an item of work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

4.

Oth	=	Other than electrical or mechanical.
Plb	=	Plumbing.
Htg	=	Heating, Ventilating & Air Conditioning
Elec	=	Electrical.
f	=	Furnished.
i	=	Installed.
p	=	Provided (furnished and installed).

Item	Oth	Plb	Htg	Elec	Notes
Motors for mechanical equipment	___	p	p	___	
Motor starters and controls for					
Plb	___	f	___	i	Specifications and drawings delineate exceptions.
Motor Starters and controls for Htg (Includes motor control centers if applicable).	___	___	f	i	Specifications and drawings delineate exceptions.
Power wiring for motors					
Htg	___	___	___	p	
Plb	___	___	___	p	
Control wiring for motors Plb	___	___	___	p	Specs. and drawings delineate exceptions.
Htg	___	___	___	___	See "Spec. Notes Pertaining to List of Electric Motors and Motor Controls" drawing for separation of work.
Temporary light and power	p	___	___	___	See General Conditions Specifications. To accommodate all trades.

Item	Oth	Plb	Htg	Elec	Notes
Temporary water	p				
Temporary heat	p				
Temporary toilets	p				
Hoisting				p	
Rigging				p	
Bracing and dunnage for safe rigging				p	
Cutting, chasing and patching				p	
Framed slots and openings in walls, decks and slabs	p				Coordination drawings are required from the electric.
Sleeves through non-waterproof slabs, decks and walls				p	Includes drilling of holes when required.
Sleeves through waterproof slabs, decks and walls				p	Includes drilling of holes for other than field poured concrete.
Waterproof sealing of sleeves through waterproof slabs, decks and walls				p	
Fireproof sealing (firestopping) excess opening spaces in slabs, decks and fire-rated walls				p	
Excavation and backfill inside buildings	p				
Excavation and backfill outside buildings				p	
Fastenings				p	
Supports				p	

Item	Oth	Plb	Htg	Elec	Notes
Flashing of electric conduits through roof (pitch pockets)	p				
Concrete foundations, pads and bases inside buildings	p				Furnishing of anchors and vibration mounts included in the electric.
Concrete foundations, pads and bases outside buildings				p	Furnishing of anchors and vibration mounts included in the electric.
Concrete lined trenches in building foundation	p				
Field touch-up painting of damaged shop coats				p	
Field rustproof painting of supporting steel members, frames and racks				p	
Finish painting of exposed work	p				Red coloring of exposed fire protection alarm systems circuitry included in electric.
Finished wall and ceiling access doors, panels and supporting frames	p				Supplying list of locations where required included in electric.
Process control systems			p		
Permanent catwalks to equipment	p				Supplying list of locations where required included in electric.
Permanent ladders to equipment	p				Supplying list of locations where required included in electric.

Item	Oth	Plb	Htg	Elec	Notes
Opening frames for ceiling recessed lighting fixtures and other electrical items.	___	___	___	p	
Luminous ceilings	p	___	___	___	Lamp strips and lamps included in electric.
Electric duct heaters (heaters installed in air ducts)	___	___	p	___	Line and control connections included in electric.
Electric heaters with integral fans, (unit heaters, cabinet heaters, fan coil units and the like)	___	___	p	___	Line and control connections included in electric.
Electric radiators (baseboard, sill line and convector type heaters).	___	___	___	p	
Electric water heaters	___	p	___	___	Line and control connections included in electric.
Electric boilers	___	___	p	___	Line and control connections included in electric.
Through wall sleeve type air conditioning and electric heating units.	___	___	___	p	
Electric heater cables for radiant space heating	___	___	___	p	
Electric heater cables for snow melting	___	___	___	p	
Electric heater cables for mechanical system pipe tracing	___	___	___	p	

Item	Oth	Plb	Htg	Elec	Notes
Electric power consuming items and controls for same not referred to above	p	p	p	____	Line and control connections to equipment included in electric.
Rubbish removal	___	___	___	p	Removal of the shipping and packing materials of electrical items is included in the electric regardless by whom the items are furnished.
Special tools for maintenance of equipment furnished as part of electric work.	___	___	___	f	

5. Include in the electrical work all necessary supervision and the issuing of all coordination information to any other trades who are supplying work to accommodate the electrical installations.

6. For items of equipment which are to be installed but not purchased as part of the electrical work, the electrical work shall include:

   a. The coordination of their delivery.

   b. Their unloading from delivery trucks driven in to any point on the property line at grade level.

   c. Their safe handling and field storage up to the time of permanent placement in the project.

   d. The correction of any damage, defacement or corrosion to which they may have been subjected.

   e. Their field make-up and internal wiring as may be necessary for their proper operation.

   f. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.

g. Their connection to building wiring including the purchase and installation of all "crown boxes" or other type of termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these specifications.

7. Items of equipment which are to be installed but not purchased as part of the electrical work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

G. Record Drawings

1. As part of the required electric work, a complete set of "as-built" or record electric drawings shall be made up and delivered to the Architect.

2. The drawings shall show:-

a. All electric work installed exactly in accordance with the original design.

b. All electric work installed as a modification or addition to the original design.

c. The dimensional information necessary to delineate the exact location of all circuitry and wiring runs (other than lighting and appliance branch circuitry and small control, signal and communications runs) which are so buried or concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.

d. The numbering information necessary to correlate all electrical energy consuming items (or outlets for same) to the panel or switchboard circuits from which they are supplied.

3. The drawings shall be produced using AutoCad version 12 software.

4. Prior to developing any "as-built" drawings, the contractor shall coordinate with the Owner and the Architect Engineer the drawing layers, colors, etc., of the CAD drawings.

5. "As-built" information shall be submitted as follows:

   a. CAD drawing files on 1.2 Mb 3-1/2" DOS disks in AutoCad version 12 format.

   b. One (1) set of reproducible drawings.

   c. Two (2) sets of blueprints.

6. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.

7. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.

1.1A CONTRACTOR'S RESPONSIBILITY REGARDING UTILITY COMPANY REBATE PROGRAMS

A. This Contractor shall as part of his quotation for Base Bid electrical work, include work in connection with Con Edison rebate programs as follows:

1. For equipment items (as listed below) which have been included in the Base Bid electrical work as part of an "energy efficient" lighting design which qualifies for Con Edison rebate programs, prepare all applications, work sheets, and other documentation required by Con Edison in order to insure their eligibility for rebate. In order to avoid possible loss of rebates, obtain written confirmation of eligibility under energy efficient lighting design rebate programs from Con Edison before placing orders for any such equipment. Schedule the filing of the documentation, the ordering of the equipment, and the installation of the equipment so as to guarantee compliance with all of Con Edison requirements. Notify the Architect in writing if these requirements will delay the building construction schedule.

2. The following electrical items are included in the Base Bid electrical work as part of an "energy efficient" lighting design which qualifies for Con Edison rebate programs:

   - Low Power Density Lighting Installations

   - Occupancy Sensors Photoelectric Daylight Controls

   - Energy Saving Flourescent Lamps plus High Efficiency Fluorescent Ballasts, or high efficiency ballasts only

1.2 QUALITY ASSURANCE

A. Products Criteria

1. All equipment furnished as part of the electrical work shall comply with the latest editions of all applicable state and municipal "energy codes". Provide certification from the equipment suppliers for all energy-consuming equipment that the equipment fully complies with these codes. Equipment submissions will not be accepted for review unless accompanied by such certification in writing.

2. Except as introduced by the required reuse of existing work all equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

3. New equipment and materials shall:-

   a. Be Underwriters Laboratories, Inc. (U.L.) labeled and/or listed where specifically called for, or where normally subject to such U.L. labeling and/or listing services.

   b. Be without blemish or defect.

   c. Not be used for temporary light and power purposes without Architect's authorization.

   d. Be in accordance with the latest applicable NEMA standards.

   e. Be products which will meet with the acceptance of the agency inspecting the electrical work. Where such acceptance is contingent upon having the products examined, tested and certified by U.L. or other recognized testing laboratory, the product shall be so examined, tested and certified.

4. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.

5. The restriction of conductors in wires to copper, as specified elsewhere, shall be understood to also apply to all conductors (wire, cable or bus as applicable), including those provided as part of factory assemblied components such as transformers, switchboards, panelboards, panelettes, bus duct, switchgear, power centers, overcurrent protection and switching devices. This restriction shall apply equally to all such equipment regardless indications (or lack thereof) elsewhere to the contrary. Aluminum will not be acceptable.

6. It is the intent of these specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

7. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

8. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of Shop Drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

9. Substitutions of ElectricalEquipment for that shown on the schedules or designated by model number in the specifications will not be considered if the item is not a regular cataloged item shown in the current catalog of the manufacturer.

B. Manufacturer's Recommendations: Where installation procedures of any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of .these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.3 SUBMITTALS In accordance with Section 01300, furnish the following:

A. Prior to purchasing any equipment or materials, a list of their manufacturers shall be submitted for review.

B. Prior to assembling or installing the work, the following shall be submitted for review:

1. Catalog information, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items of equipment.

2. Upon request, submit for review prior to installation, floor plans showing circuit numbers, home runs, and interconnecting circuitry for all lighting and appliance outlets.

3. Upon request, submit for approval one sample of each of the following:

a. Each type of lighting fixture.

b. Each type of wiring device and device plate.

c. Each type of fire alarm actuating and alarm sounding or flashing device.

C. Documents will not be accepted for review unless:

1. They include complete information pertaining to appurtenances and accessories.

2. They are submitted as a package where they pertain to related items.

3. They are properly marked with service or function, project name, where they consist of catalog sheets displaying other items which are not applicable.

4. They indicate the project name and address along with the Contractor's name, address and phone number.

5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

6. Equipment and materials requiring New York City MEA or BSA approval shall be submitted with the MEA or BSA number and with a reprint of the MEA or BSA approval.

D. Shop Drawing Review

1. The purpose of the review of shop drawings is to maintain integrity of the design. Unless the contractor clearly points out changes, substitutions, deletions or any other differences between the submission and the Contract Documents in writing on the Contractor's letterhead, approval by the Engineer or Architect does not constitute acceptance. It is not to be assumed that the engineer has read the text nor reviewed the technical data of a manufactured item and its components except where the Vendor has pointed out differences between his product and the specified model.

2. It is the responsibility of the contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by him with other trades. Approval of shop drawings containing errors does not relieve the contractor from making corrections at his expense.

3. Substitutions of equipment, systems, and materials, must be coordinated by the Contractor with his own or other trades which may be involved with the item, such as, but not limited to, equipment substitutions which change or hanging or support weights or dimensions.

4. Any extra changes or credits which may be generated by other trades due to substitutions will not be accepted unless the Contractor has an agreement in writing with the Owner.

5. Substitutions of equipment, systems, etc. requiring approval of local authorities must comply with such regulations and be filled at the expense of the Contractor (should filing be necessary). Substitutions are subject to approval or disapproval by the Engineer. The contractor in offering substitutions shall hold the Owner and Engineer harmless if the substituted item is an infringement of patent held by the specified item.

E. Explanation of Shop Drawing Stamp

1. Approval indicates that we have not found any reason why this item should not be acceptable within the intent of the documents.

2. As Noted indicates that we have found questionable components which if corrected or otherwise explained make the product acceptable.

3. Resubmit indicates that this item should be resubmitted for approval before further processing.

   a. If both "As Noted" and "Resubmit" are checked, the resubmittal is for record purposes only.

4. Not Accepted indicates that the item will not meet the intent of the Contract.

5. No shop drawing stamp or note shall constitute an order to fabricate or ship. Such notification can only be performed by the Project Manager for Construction, the Contractor scheduling his own work, or the Owner.

F. Maintenance Data and Operating Instructions:

1. Maintenance and Operating Manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Paragraph, INSTRUCTIONS, for systems and equipment.

2. After all final tests and adjustments have been completed, fully instruct the proper Owner's Representative in all details of operation for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is properly qualified to take over operation and maintenance procedures. Supply qualified personnel to operate equipment for sufficient length of time as required to meet all governing authorities in operation and performance tests.

3. Furnish required number of manuals, in bound form containing data covering capacities, maintenance of operation of all equipment and apparatus. Operating instruction shall cover all phases of control and include the following:

   a. Performance Curves: For lighting fixtures and other equipment as requested.

   b. Lubrication Schedule: Indicating type and frequency of lubrication required.

   c. List of Spares: Recommended for normal service requirements.

   d. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.

   e. Instruction Books may be standard booklets but shall be clearly marked to indicate applicable equipment.

   f. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.

4. Where applicable, one set of operating and maintenance instructions shall be neatly framed behind glass and hung adjacent to the equipment concerned.

1.4 SEISMIC

A. Seismic restraints and/or bracing shall be provided for selected electrical equipment and wiring methods as described hereinafter. These seismic design requirements are complementary to the requirements specified elsewhere for the fastening and support of electrical work. Nothing on the drawings or elsewhere in these specifications shall be interpreted as a reason to waive any of the requirements of this Seismic Design section.

B. Installation of electrical equipment shall, as a minimum, be installed in accordance with the latest applicable edition of the Building Code of the City of New Yorkthe BOCA National Building Codethe Uniform Building Codethe Southern Building Code Congress Internationalthe Building Code of the Commonwealth of Massachusetts.

C. This project is located in Seismic Zone _2_ an area with an effective peak velocity-related acceleration coefficient (A_v) of ___

Generators, day tanks, and associated piping
Automatic transfer switches
Emergency panelboards
Emergency dry type transformers
Emergency lighting fixtures and exit signs
All pendant or ceiling mounted lighting fixtures if located in public corridors or other portions of egress paths
Emergency battery packs &/or central systems
Inverter systems
Fire alarm/detection systems
All raceways supplying emergency lighting/power
fire alarm/detection system devices
Raceways mounted in or above public corridors or paths of egress on individual hangers longer than 12" or suspended on trapezes or larger than 2" in size.

D. All seismic restraint and isolation devices, braces, and supports shall be capable of accepting without failure forces produced by seismic acceleration (expressed in multiples of the acceleration of gravity "G") based on the level above grade of the attachment of the equipment support system. For design purposes, the following acceleration levels shall be used:

INCLUDE ONLY THE APPROPRIATE ZONE/A_v

DESIGN LEVEL OF ACCELERATION AT EQUIPMENT CENTER OF GRAVITY			
SEISMIC ZONE 2	A_v = 0.10 TO		
BELOW GRADE UP TO 20 FEET ABOVE GRADE	0.125 "G"	0.500 "G"	
21 FEET - 300	0.500 "G"	0.750 "G"	1.000 "G"
301 FEET - 600	0.750 "G"	1.000 "G"	

E. OEM Equipment Isolation Packages

1. Internal and/or External Systems

a. Substitution of internally or externally isolated or restrained equipment instead of the isolation and restraints specified in this section is acceptable provided all requirements of this section are met. The equipment manufacturer shall provide a letter of guarantee from their Engineering Department stamped and certifying that the seismic restraints are in full compliance with these specifications. Letters from field offices and representatives are unacceptable.

b. All costs for converting to the specified vibration isolation and /or restraints shall be borne by the equipment manufacturer in the event of non-compliance with the preceding.

c. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure.

F. Submittal Data Requirements

1. Seismic Certification and Analysis

a. Provide seismic restraint calculations certifying that all seismic restraint devices are capable of accepting, without failure, the "G" forces shown in the table above. Calculations shall be provided for all connections of the equipment to the structure. All performance of products (such as strut, cable, anchors, clips, etc.) associated with restraints must be supported by the manufacturer's data sheets or certified calculations. For roof mounted equipment, both the seismic acceleration and wind loads shall be calculated. The highest load shall be used for the design of the restraints and isolators.

b. Calculations to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience.

c. Analysis must indicate calculated dead loads, derived loads, and materials used for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and /or weld length.

G. Related Work

1. Housekeeping Steel

a. Where steel sills are called for under a piece of electrical equipment, attachment shall be designed and certified according to this section by the seismic/isolation supplier.

b. Steel sills shall be sized to accommodate a minimum of six inches of clearance all around the equipment and its mounting package. In addition, 3/4" clearance shall be provided between the equipment the electrical equipment and the steel sills so that the space may be kept clear of debris that would inhibit the isolation.

2. Supplementary Support Steel

a. Structural support and connections for all electrical equipment, including roof mounted equipment, specified in other sections shall comply with the seismic requirements of this section.

3. Design Responsibilities

a. Include the following in the responsibility of the seismic equipment supplier.

1) Determine guidelines for vibration isolation and restraint size and location.

2) Provide equipment vibration isolation and seismic restraints as required.

3) Guarantee specified isolation system deflections.

4) Provide installation instructions, drawings, and field supervision to insure proper installation and performance of systems.

5) Certify correctness of installation upon completion.

H. Description

1. Devices

a. All vibration isolation and seismic devices described in this section shall be the product of a single manufacturer. That manufacturer may be AVNEC, Inc. of Floral Park, NY, Mason Industries, Inc. of Hauppage, NY, Vibration Mounting and Control, of Butler, NJ, and Consolidated Kinetics, of Columbus, OH. Other manufacturers are acceptable provided their systems strictly comply with intent, structural design, and performance of these specifications.

2. Attachments

a. Hardware and devices such as beam clamps, anchor bolts, cables, and cast-in-place plates must be by this section's supplier to ensure seismic compliance and certification. Alternate anchor bolts may be provided so long as the sizing and dimensions on the seismic submittals are followed.

I. Seismic Restraints and Vibration Isolators

1. General

a. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by the seismic certification and calculations described above.

b. Corrosion protection for both indoor and outdoor applications shall be as follows:

1) Springs - Cadmium plated, zinc electroplated, or powder coat

2) Hardware - cadmium plated

3) All other metal parts - hot spray or hot dipped galvanized.

c. All seismic restraint devices:

1) shall maintain the equipment in a captive position not short circuit isolation devices during normal operating conditions.

2) shall have provisions for bolting and/or welding to the structure.

2. Seismic Restraint Types

a. Restraints for suspended systems

1) Isolated systems and, where required elsewhere by this specification, lighting fixtures -- braced with multiple steel cable with approved fastening devices to equipment and structure.

2) Non-isolated systems -- braced with structural steel strut with approved fastening devices to equipment and structure.

b. Restraints for systems rigidly connected to walls or floor or ceiling slabs.

1) Rigid attachment to structure using wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with ICBO National Standards for seismic anchorage.

3. Vibration Isolator Types

a. For Emergency Generators within the Building Structure -- Spring Isolator, Restrained

1) Spring shall have minimum outer diameter to overall height ratio of 0.8: 1 at rated deflection.

2) Reserve deflection (from that at published rated load to solid height) equal to 50 % of the rated deflection.

3) Formed steel or ductile top cup with adjusting bolt and locking cap screw for securing to equipment.

4) Minimum 1/4" thick neoprene acoustical base or cup on underside, unless designated otherwise.

5) Capable of increasing vertical height by a minimum of 3/4". The integrity of restraint hardware shall not be compromised by these leveling features.

6) Integral restraining bolts with elasrometric cushions preventing metal-to-metal contact.

7) Internal spring adjusting nut or bolt with leveling capability.

8) Capable of supporting equipment at fixed elevation during equipment installation.

9) Built-in all directional limit stops with minimum 1/4" clearance under normal operation.

b. For Dry Type Transformers --

1) Double deflection neoprene isolator encased in ductile iron or steel casing.

c. For Conduit Risers -- Resilient Conduit Anchors and Guides

1. One inch of six pound density Fiberglas packed around the conduit.

J. Flexible Connectors

1. All connectors to the generator and day tank shall be installed on the equipment side of shut off valves. Piping shall be supported and/or anchored to resist pipe movement beyond the allowable movement of the flexible connector.

K. Application

1. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all submittal data.

2. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

L. Installation

1. Equipment shall be restrained as indicated in the table at the end of this specification.

2. Additional Requirements

a. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators, and restraints.

b. Spring isolators shall be installed after all equipment is installed without changing equipment elevations.

c. After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.

d. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment's movement shall be free in all directions.

e. All electrical connections to isolated equipment such as transformers and generators shall be in flexible conduit.

f. Use wedge type expansion bolts to bolt the base to the structure.

M. Seismic Restraints

1. Installation

a. All equipment specified to receive seismic support shall be restrained per the table at the end of this section.

b. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted, or welded to the structure to comply with the required acceleration. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.

c. Lighting fixtures shall be seismically restrained in accordance with the following:

(1) All lighting fixtures mounted in the paths of egress, and all emergency fixtures and exit signs throughout the building shall be provided with seismic restraints.

(2) Lighting fixtures recessed into suspended ceilings shall be supported from the ceiling structure by not less than two earthquake clips, or other approved supports, each capable of supporting 50 % of the fixture weight.

(3) Lighting fixtures surface mounted on the underside of suspended ceilings shall be provided with at least two supports, each independently connected to the slab above with cable type restraints as described hereinbefore for suspended systems and each capable of supporting 100 % of the fixture weight.

(4) Pendant mounted lighting fixtures shall be supported from the slab above utilizing approved fixture hangers designed to permit a swing of at least 20° in any direction without damage to the fixture, hangers, or structure. Each support shall be capable of supporting 100 % of the fixture weight. If there are obstructions preventing the free swing, provide additional support bracing to restrain 50 % of the fixture weight. Pendant mounted fixtures below suspended ceilings shall be supported at the ceiling level and shall have cable ties to the slab above.

(5) Lighting fixtures surface mounted directly to ceiling slabs, walls or structural elements shall be rigidly attached using restraints specified hereinbefore for rigidly connected ceiling slabs or walls.

d. All horizontally suspended cable trays, and conduit systems shall use restraints for non-isolated suspended systems. Spacing of seismic bracing shall be according to table below. All bus ducts and cable trays passing through floors shall be bolted at each floor level or secured above and below each floor with riser clamps. This restraint shall be in addition to the spring type hangers specified in Section 16400.

SEISMIC BRACING TABLE			
EQUIPMENT	ON CENTER SPACING		WITHIN EACH CHANGE OF DIRECTION
	TRANSVERSE	LONGITU-DINAL	
CONDUIT	40 FEET	80 FEET	10 FEET OR 15 DIAMETERS
CABLE TRAY	40 FEET	80 FEET	10 FEET

e. For all seismically supported trapeze supported conduit, the individual conduits shall be transversely and vertically restrained to the trapeze support at the designated restraint locations. Restrain at least every third trapeze hanger transversely and every fifth one longitudinally as well as the trapeze on both sides of every change of direction.

f. For overhead supported equipment, overstress of the building structure must not occur. Bracing may occur from:

(1) Flanges of structural steel beams.

(2) Upper truss chords in bar joists.

(3) Cast in place or drilled and shielded inserts in concrete structures.

For dry type transformers suspended from the slab above, use isolators with 0.20" deflection and seismic restraints for isolated, suspended equipment.

g. Where conduits pass through cored or sleeved holes, the holes shall be a maximum of 2" larger than the conduit O.D. Pack the space with fireproofing material. No additional horizontal seismic bracing is required at these locations.

h. All non-isolated floor or wall mounted equipment such as substations, switchboards, panelboards, etc. which require restraint shall use restraint for rigid attachment. For floor mounted transformers up to and including 300 kva, use isolators with a 0.30" deflection and rigid attachment seismic restraints. For larger transformers, provide a calculation for the isolators and restraints required. Where base anchoring of equipment such as UPS's or switchboards is insufficient to resist seismic forces, additional restraints for suspended, non-isolated equipment shall be located above the unit's center of gravity to suitably resist "G" forces specified.

I. Emergency generators shall be a "factory package" mounted on rigid base consisting of a full length skid or rail of structural steel on each side and cross bracing members at each end. An additional auxiliary matching rigid base shall be furnished and installed anchored to the floor as dunnage.

The emergency generator set shall be resiliently isolated from the building structure or grade by means of bare stable spring isolators (with 1.50" deflection and 0.10" deflection respectively) mounted between the rigid base of the generator and the matching auxiliary base. Provide seismic restraints for rigid attachment.

N. Inspection

1. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the manufacturer shall be submitted in writing to the architect/engineer indicating that all systems are installed properly and in compliance with the specifications. The report shall identify those areas that require corrective measures or certify that none exist. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in this report.

1.5 ALTERNATE PRICE QUOTATIONS

A. Submit a spearate price quotation for changes to the Base Bid electrical for each alternate as described hereinafter.

1. Installation of alternate generator system - See Pre-Purchase Specs.

1.6 WORK INCLUDED

A. Basic electrical materials and methods as described.

1.7 RELATED WORK

A. Section 16400 - Service and Distribution

B. Section 16500 - Lighting

C. Section 16600 - Special Systems

D. Section 16700 - Communications

E. Section 16950 - Testing

1.08 REFERENCES

A. New York City Electrical Code

B. New York City Building Code (and Reference Standards)

C. ANSI C80.1 - Rigid Steel Conduit

D. ANSI C80.3 - Electric Metallic Tubing

E. ANSI C80.5 - Rigid Aluminum Conduit

F. NEMA TC2, TC3 - Electrical Plastic Conduit and Fittings

G. FS W-C-58Z - Surface Metal Raceway

H. ANSI/NEMA - OSI - Sheet Metal Outlet Boxes

I. ANSI/NEMA - FBI - Cast Metal Boxes

J. NEMA WD1 - General Purpose Wiring Devices

K. Port Authority Standards

PART 2 - PRODUCTS

2.1 SELECTION OF WIRING MATERIALS FOR LIGHT AND POWER CIRCUITRY AND DISTRIBUTION

A. Except where specialty wiring methods are called for utilize wiring methods selected in accordance with the following list. Utilize threaded metallic conduit with wires pulled in as the wiring method for all purposes and in all locations not covered by the following list and where all the listed wiring methods are excluded.

WIRING METHOD	APPLICATION (Subject to restrictions noted hereinafter)
Threaded metallic conduit with wires pulled in	Feeders supplying smoke exhaust fans, stair pressurization fans, and
	Main and submain feeders Branch feeders. Lighting and appliance branch circuit.
Electric metallic tubing with wires pulled in	Main and submain feeders.
	Branch feeders.
	Lighting and appliance branch circuitry.

B. Exclude electric metallic tubing from concrete embedded installations.

C. Exclude electric metallic tubing from installations subject to mechanical damage.

D. (Not Used)

E. Threaded metallic conduit is required for all "normal" and "emergency" feeders to fire pumps. Conduit shall be encased in 2" of concrete (or other code approved equivalent) where conduits are not physically routed outside building. Omit concrete for special purpose, booster, or jockey pumps.

F. Threaded metallic conduit is required for feeders supplying smoke exhaust fans, stair pressurization fans, booster fire pumps and , back from the equipment itself to the points of normal and emergency service. For these feeders this shall be understood to mean rigid galvanized steel conduit or aluminum conduit.

G. Exclude electric metallic tubing from exposed installations in finished spaces.

H. (NOT USED)

I. Where non-flexible raceway wiring methods are specified, the following exceptions to the above are made:-

1. Final connections to motor and motorized equipment shall be made with 18" of UL listed grounding type neoprene sheathed flexible metallic conduit installed with grounding type connectors. For conduit larger than 1-1/4", for 3/4" through 1¼" conduits where upstream overcurrent device exceeds 60 amps, and for 1/2" conduits where upstream device exceeds 20 amps, provide bonding jumper within - or tied to - the flexible conduit.

2. Final connections to individually mounted dry type transformers shall be made with 18" minimum of UL listed grounding type flexible metallic conduit installed with grounding type connectors. For conduit where upstream device exceeds 20 amps, provide bonding conductor within - or tied to - the flexible conduit.

3. Other final connections indicated as being made with UL listed flexible metallic conduit shall be so made utilizing grounding type conduit, no more than 36" in length, and shall be installed with grounding type connectors. For conduits where upstream device exceeds 20 amps, provide bonding conductor within - or tied to - the flexible conduit.

4. UL listed grounding type flexible metallic conduit extensions from horizontal runs of non-flexible raceway shall be used within hollow prefabricated or existing partitions, or existing non-removable ceilings where the installation of non-flexible raceway would be impossible. Grounding type connectors shall be used for the flexible extensions.

2.2 REQUIREMENTS GOVERNING ELECTRIC WORK IN DAMP OR WET LOCATIONS WITHIN BUILDING CONFINES

A. Abide by the requirements specified for normal electric work conditions except:-

1. NOT USED.

2. NOT USED.

3. Utilize watertight compression gland type fittings only on electric metallic tubing.

4. The finish for threaded steel conduit shall be galvanized only.

5. Exclude aluminum conduit.

6. Outlets and outlet size boxes and fittings shall be of galvanized cast ferrous metal only.

7. Conductors #1 AWG and smaller for pulling into raceways shall have permissible insulation types limited to "THWN" or "XHHW."

8. Conductors 1/0 AWG and larger for pulling into raceways shall have permissible insulation types limited to "THHW-2", "THWN-2" or "XHHW-2".

9. Apply one layer of half lapped plastic electric insulating tape over wire nuts used for joining the conductors of wires.

10. Exclude split insulating casings for insulating joints and taps in conductors of wires and cables.

12. Wiring device plates shall be galvanized sheet steel or cast ferrous metal except that in finished spaces, they shall be of type 302 non-magnetic stainless steel.

13. Plates for toggle switches and receptacles shall have gasketed snap-shut covers.

14. Final connections of flexible conduit shall be of the neoprene sheathed type.

15. Enclosures, junction boxes, pull boxes, cabinets, cabinet trims, wiring troughs and the like, shall be fabricated of galvanized sheet metal, shall conform to the following:-

    a. They shall be constructed with continuously welded joints and seams.

    b. Their edges and weld spots shall be factory treated with cold galvanizing compound.

    c. Their connection to circuitry shall be by means of watertight hub connectors with sealing rings.

    d. Enclosures for individually mounted switching and overcurrent devices shall be NEMA Class IV (watertight) construction.

16. The covers, doors, plates and trims used in conjunction with all enclosures, pull boxes, outlet boxes, junction boxes, cabinets and the like, shall be equipped with gaskets.

17. All enclosures, cabinets, junction and pull boxes (larger than outlet box size) and the like, shall be equipped with breather and drain fittings.

18. Panels shall be equipped with doors without exception.

19. Individually mounted dry transformers shall be of the non-ventilated outdoor type.

B. The following shall be treated as damp or wet locations within building confines, regardless of whether or not a high ambient moisture level is found to exist:-

1. Spaces where any designations indicating weatherproof (WP) or vaporproof (VP) appear on the drawings.

2. Exterior areas.

3. Kitchens up to a height of 18" above finished floor.

4. Emergency Generator Rooms

C. Electric work in slabs, walls or suspended ceilings which bound on a space defined as a damp or wet location shall meet the damp or wet location requirements if it enters into, or opens into the damp or wet location in any way.

2.3 THREADED METALLIC CONDUIT

A. Select threaded metallic conduit in accordance with the following:-

1. For feeders (both "normal" and "emergency") to fire pumps (including jockey pumps, booster pumps and special service pumps) and control circuits therefore, it shall be rigid (heavy) wall galvanized steel. Unless feeders are physically routed outside building (excluding runs within electric switchgear room and pump room) shall be encased with 2" of concrete or the code authority approved equivalent. This encasement requirement shall pertain only to the feeders to main pumps, ie, not to control circuits and not to feeders to special purpose, booster or jockey pumps.

2. Threaded metallic conduit is required for feeders supplying smoke exhaust fans, stair pressurization fans, and , back from the equipment itself to the points of normal and emergency service. For these feeders this shall be understood to mean rigid galvanized steel conduit.

3. Except as noted above, it shall be industry standard intermediate weight steel or rigid heavy wall aluminum conduit except exclude aluminum from concrete embedded installations also exclude aluminum from installation subject to mechanical damage.

4. It shall not be less than 3/4" trade size.

5. Steel conduit shall be galvanized.

6. Steel conduit galvanizing shall be by means of industry standard process which applies the galvanized plating after factory threads are cut.

B. Not Used

C. Rigid steel or intermediate weight conduit shall be manufactured by Triangle, Allied Tube or Wheatland Tube or other approved.

D. Rigid heavy wall aluminum conduit shall be manufactured by Electriflex, VAW of America, Alflex or other approved.

2.4 ELECTRIC METALLIC TUBING (THIN WALL CONDUIT)

A. Select electric metallic tubing in accordance with the following:-

1. It shall be industry standard thin wall conduit of galvanized steel only.

2. It shall not be less than 3/4" trade size.

B. Electric metallic tubing shall be manufactured by Triangle, Allied Tube, Wheatland Tube or other approved.

2.5 WIRES FOR LIGHT AND POWER CIRCUITRY AND DISTRIBUTION

A. Conductors shall be of soft 98% minimum conductivity properly refined copper, solid construction where #10 A.W.G. and smaller, stranded construction where #8 A.W.G. and larger.

B. Insulation shall be rated for 600 volts and shall conform to industry standard types as follows:-

UTILIZATION	ACCEPTABLE TYPES
Conductors #1 AWG and smaller	XHHW
Conductors 1/0 and larger in "dry" locations	XHHW
Conductors 1/0 and larger in "wet" locations	XHHW-2,

c. In general, cable ampacities shall be based on a 60°C rating for cables #1 AWG and smaller, and on a 75°C rating for larger cables. In conjunction with this, note the following:

1. 75°C ratings may be utilized for cables #1 AWG and smaller where overcurrent protection and switching devices (OCD's), wiring devices and solidly connected equipment connected to such cables are listed and identified for use with 75°C rated conductors. (Note that these specifications require all OCD's - regardless of ampere rating to be suitable for use with 75°C rated conductors).

2. Increase indicated cable (and raceway) sizing as required for circuitry where conductors #1AWG and smaller will connect directly to:

   a. Solidly connected utilization equipment whose load current will exceed the 60°C rating of the cable, and for which manufacturer's approval for cable terminations is less than 75° C.

   b. Receptacles whose ampere rating exceeds the 60°C rating of the connected cables unless such receptacles are listed for use with 75°C rated conductors.

2.6 JUNCTION BOXES, PULL BOXES, OUTLET BOXES AND WIRING TROUGHS

A. Select junction boxes, pull boxes and wiring troughs in accordance with the following:-

1. Except as noted below, they shall be manufactured from galvanized industry standard gauge sheet steel.

2. They shall be supplied in non-standard shapes where necessary for a neat workmanlike application to special building configurations.

3. When junction or pull boxes are of outlet box size, they shall conform to the specifications governing outlet boxes for lighting fixtures and wiring devices.

4. Box covers shall conform to the following:-

Box	Cover
Large (i.e., custom built or not standard outlet type), set in any location	Galvanized sheet steel fastened with countersunk flat head screws.
Small (i.e., standard speci- outlet), set flush with wall or partition surface	Blank plate of the type fied for flush wiring de- vices.
Small, set flush with ceiling surface	Blank cover as supplied standard for box.
Small, surface mounted stan- or totally concealed from view	Blank cover as supplied dard for box.

5. Where boxes have any single horizontal dimension larger than 36 inches, they shall be fitted with cable support racks consisting of 3/4 inch diameter steel pipes with flanged ends bolted to the side or frame of the pull box. Each pipe support shall be fitted with a continuous fiber insulating sleeve. The pipe supports shall be arranged in tiers corresponding to the cables entering and leaving the box. Sufficient pipe support racks shall be included within the pull box so that no cable shall remain unsupported for a horizontal distance greater than 36 inches. In no case shall cable support pipe racks be mounted so that they interfere with the removal of screw covers.

6. Wiring trough covers shall be of galvanized sheet steel fastened with countersunk flat head screws.

B. Select outlet boxes in accordance with the following:-

1. They shall be industry standard types.

2. Round or octagon boxes shall not be less than 4" in diameter.

3. They shall be of metal. They shall be of the size and depth necessary to suit building construction, to allow for easy wiring and installation of wiring devices and to meet industry standard minimum occupancy requirements.

4. Sheet metal boxes shall be of galvanized steel.

5. Cast metal boxes (where called for either below or elsewhere) shall be of galvanized ferrous metal or aluminum except exclude aluminum where aluminum conduit is excluded.

6. All sheet metal boxes shall have suitable knockouts.

7. All cast metal boxes shall have properly drilled and tapped holes.

8. Galvanizing shall be by an industry standard method which applies the galvanized plating after the boxes are cut, formed and welded, or cast, drilled and threaded.

9. Boxes for lighting fixture outlets shall conform to the following:-

FIXTURE TYPE	PLACEMENT OF CIRCUITRY	BOX TYPE
Ceiling surface or pendant	Concrete embedded	Sheet metal octagon concrete ring, with top cover having a fixture stud.
	Exposed	Sheet metal octagon or round with fixture stud.
	Concealed in suspended ceilings	Sheet metal octagon with hanger bars and fixture stud.
Wall bracket	Exposed	Sheet metal octagon or round with fixture stud.
	Concealed in wall construction to which separate finish is is applied.	Sheet metal square with round opening raised cover and fixture stud.
	Concealed in wall construction which is integrally finished or is left unfinished.	Sheet metal octagon with fixture stud.
Recessed pigtail connected	Concealed in suspended ceiling	Sheet metal square with hanger bars and blank cover.

10. Boxes for wiring device outlets shall conform to the following:-

DEVICE MOUNTING	PLACEMENT OF CIRCUITRY	BOX TYPE
Flush in wall	Concealed in wall construction to which separate finish is applied.	Sheet metal square or multigang with rectangular opening raised cover.
	Concealed in wall construction which is integrally finished or is left unfinished	Sheet metal single or multigang utility or, where depth of construction permits, sheet metal square or multigang with rectangular opening raised cover.
Exposed on wall	Exposed	Cast metal "FS" type single or multigang.
Floor stanchion	Concealed in suspended ceiling below	Sheet metal square or octagon, mounted in suspended ceiling below, complete with approved fire-rated through-the-floor fitting.
Flush in floor and in floor stanchion	Concrete embedded	Sheet metal square or octagon cast metal round complete with exterior side lugs and levelling screws suitable for full adjustment to depth of floor construction. Also complete with after set adjusting ring and gasketed floor plate.
Free standing on circuitry stubbed up from floor	Concrete embedded or concealed in suspended ceiling below	Cast metal "FS" type sheet metal utility.

11. Select outlet boxes for other items on the same basis as for lighting fixtures and wiring devices.

11A. Regardless of any indications on the drawings, flush wall mounted outlet boxes shall not be set back-to-back in fire rated walls or partitions, even if they are displaced vertically. Such outlets shall be offset horizontally by 2'-0" or as otherwise required to maintain the fire rating.

12. Exclude "through the wall" collar type outlet boxes for flush devices indicated back to back in non-fire rated partitions or walls. Where necessary to accommodate box depths, outlets shown back to back shall be horizontally offset.

13. Outlet boxes for use with surface metal raceway shall be of the type which accepts standard side flush type wiring device plates without overlap.

C. Locate all boxes so that their removable covers are accessible without necessitating the removal of parts of permanent building structure, including piping, ductwork, and other permanent mechanical elements.

D. In conjunction with concealed circuitry, abide by one of the following instructions (as may be applicable to the conditions) in order to assure the aforementioned accessibility:- (not required for circuitry concealed by removable suspended ceiling tiles).

1. For a small (outlet size) box on circuitry concealed in a partition or wall -- locate box or fitting so that its removable cover side (or the face of any applied raised cover) penetrates through to within 1/8 inch of the exposed surface of the building materials concealing the circuitry and apply a blank or device plate to suit the functional requirements. Note that in a partition or wall constructed of sheet or panelling type materials, the above requirement (except where raised covers are used) excludes the setting of a box or fitting with its removable cover side edges aligned with or back of the surface of any stud or furring strip to which the material is to be applied.

2. For a large box on circuitry concealed in a partition, suspended ceiling or wall -- locate box totally hidden but with its removable cover directly behind an architectural access door or panel (included for the purpose, separate from the electric work) in the building construction which conceals the circuitry.

3. For a small (outlet size) box on circuitry concealed above and intended as an outlet for a surface mounted lighting fixture or other such electrical item -- locate box so that its removable cover side penetrates through to the exposed surface of the building materials concealing the circuitry. Arrange the mounting of the lighting fixture or other item so that it completely covers the opening in the building construction caused by the box.

4. For a small (outlet size) box on circuitry concealed in a suspended ceiling and intended as a junction or pull box or as an outlet for a non-demountable type of recessed lighting fixtures or other such electrical items -- locate box totally hidden but with its removable cover side directly behind an access panel (included for the purpose, separate from the electric work) in the building construction which conceals the circuitry.

5. For a small (outlet size) box on circuitry concealed in a suspended ceiling, and intended as an outlet for a non-demountable type of recessed lighting fixtures or other such electrical items -- locate box totally hidden but insure that the fixture or other item is of a type which permits access through itself to the box.

6. For a small (outlet size) box on circuitry concealed in a suspended ceiling, and intended as an outlet for a demountable, flexible pigtail equipped type of recessed lighting fixtures or other such electrical items -- locate box totally hidden but with its removable cover not more than one foot away from the building construction opening occupied by the demountable item.

E. Boxes shall be manufactured by RACO, Oz/Gedney, Steel City or other approved.

2.7 WIRING DEVICES

A. Select standard wiring device type switches for local control of lighting and appliance branch circuitry as per indications for single pole, two pole, three way and four way, and in accordance with the following:-

1. They shall be toggle handle type.

2. They shall be of the A.C. quiet design.

3. Exclude compact or "despard" type.

4. They shall have screw type terminals utilizing brass screws only.

4A. Their mounting straps shall be equipped with self-grounding features to insure that metal face plates will be effectively grounded without requiring a bonding jumper.

5. Where used in circuitry operating with line to neutral volts in the range of 250 to 300, they shall be rated at 20 amps, 277 volts line to neutral.

6. Where used in circuitry operating with line to neutral volts in the range of 100 to 125, they shall be rated at 15 amps, 115 volts line to neutral.

7. Their toggle handles shall, for each type (single pole, three-way, etc.) be colored:-

   a. 100% Special colors to be selected.

8. Where installed in circuitry supplied from the emergency distribution system, they shall have ivory or clear (as directed) illuminated handles of the "lit when switch off" type.

9. Where indicated with separate pilot, each shall be equipped with a correct voltage pilot lamp socket, pilot lamp and red jewel in an adjacent gang.

10. They shall be specification grade.

11. Submit manufacturers certification that switches are able to handle their rated currents through fifty thousand (50,000) "close-open" cycles of operation, at specified voltage, without noticeable deterioration, regardless of whether they are controlling inductive or resistive (including tungsten) loads.

B. Non-standard wiring device type switches shall incorporate applicable requirements for the standard type and shall be as indicated.

C. Select standard convenience receptacles in accordance with the following:-

1. They shall be grounding type, three wire (two circuit wires plus ground) single or duplex as indicated, rated for 125 volts, 15 amps, for regular outlet mounting, and with NEMA 5-15R face slot configuration.

2. Their mounting straps shall be equipped with self-grounding feature at fastening screw holes to assure solid grounding and to eliminate the need for bonding jumpers to outlet boxes.

3. They shall have screw type terminals utilizing brass screws only (plated brass for neutral connections).

4. Exclude compact or "despard" type.

5. They shall have "double wipe current carrying contacts of the full "T" slot design, and "double wipe" grounding contacts.

6. They shall have two piece molded housings.

7. They shall be specification grade.

8. Except as noted below, their faces shall be colored:-

   a. 100% Special colors to be selected.

9. The faces of receptacles wired on emergency circuits shall be colored red.

10. Where they are indicated as duplex and as being wired on two circuits, they shall be provided with a separate neutral and a separate "hot leg" terminal for each half. Single circuit duplex convenience receptacles with "break off" feature, arranged in the field to accommodate the required dual circuitry, will be accepted providing they have the specified number of terminals.

D. Where ground fault circuit interrupting (GFI, GFCI) type receptacles are indicated, they shall incorporate "through feed" features permitting the optional protection of downstream receptacles if desired.

E. Non-standard convenience receptacles and special purpose power supply receptacles shall incorporate applicable requirements for the standard convenience type and shall be as indicated.

F. Select plates for flush wall mounted wiring devices which are not integrally equipped with same in accordance with the following:-

1. They shall have openings which are of the correct shape for their associated wiring devices.

2. 100% of their overall total shall be "060" brass with finish as directed.

G. For unfinished spaces, select plates for surface wall mounted wiring devices which are not integrally equipped with same, in accordance with the following:-

1. They shall have openings which are of the correct shape for their associated wiring devices.

2. They shall be of galvanized sheet steel and shall be of the formed raised type which does not overlap the outlet box.

3. Where intended for toggle switches, they shall have toggle guards.

H. Select floor stanchions for receptacles in accordance with the following:-

1. They shall accommodate single or duplex or double duplex receptacles as indicated.

2. They shall consist of die cast aluminum zinc alloy housing of low silhouette rectangular design.

3. They shall be of a design which is standard not only for receptacles, but also for the telephone outlets hereinafter specified.

4. They shall not carry any visible manufacturer identification markings.

5. They shall be of a standarized design throughout the project regardless of whether or not they are served fromm floor outlet boxes or from the specialty "cast-in-floor" raceway facilities specified elsewhere.

6. The total quantity of floor stanchions, supplied for each type of wiring device, shall be finished:-

a. 100% in brushed brass.

I. Where supplied for circuitry run in the hung ceiling below, stanchions each shall be of the "dual service" type, integrated with an approved fire-rated through-floor fitting capable of accommodating 120 volt and/or telephone/signal wiring and devices.

J. Select flush floor outlet fittings for receptacle in accordance with the following:-

1. They shall consist of polished forged brass floor plates and flanges to accommodate floor finishes for single or duplex receptacles as indicated.

2. They shall be supplied with matching threaded type blanking caps as well as rings for the protection of attachment plugs on appliance cords. One blanking cap and one protection ring shall be supplied for each opening in each floor plate to which a plug can be applied.

3. They shall be of a standardized design throughout the project regardless of whether or not they are served from floor outlet boxes or from the "specialty cast-in-floor" raceway facilities specified elsewhere.

K. Wiring devices and wall plates shall be manufactured by Hubbell, Arrow-Hart and Hegeman, General Electric, or Bryant or other approved.

L. Floor stanchions and flush floor outlet fittings shall be manufactured by General Electric, H.H. Robertson, Square D or Walker Brothers or other approved.

2.8 CIRCUITRY FOR MISCELLANEOUS LOW VOLTAGE SYSTEMS

A. This sub-section is intended to apply to systems operating at less than 120 volts nominal and which are shown on the drawings and which are not covered in Section 16700 of this specification. Wiring for such systems shall comply with the requirements specified below unless such requirements are exceeded by information shown on the drawings or specified elsewhere.

B. For low voltage systems where circuits are power limited in accordance with Class 2 or Class 3 requirements (as defined in Article 725 of the National Electrical Code) utilize cables having characteristics as follows:

1. Cables shall be of fluoropolymer type, shall have adequate fire resistant and low-smoke producing characteristics and shall be U.L. listed for plenum use (i.e., Type CL2P for Class 2 circuits and CL3P or CMP for Class 3 circuits) except as follows:

   a. Where run in conduit, they <u>may</u> be U.L. listed for general use on Class 3 circuits (i.e., <u>Type CL3</u>).

   b. Where run in cable trays, they <u>shall</u> be U.L. listed as <u>Type CMP</u>.

C. For low voltage systems whose circuits are not power limited Class 2 or Class 3 (in accordance with the requirements of Article 725 of the National Electrical Code), and which are not telecommunications circuitry (in accordance with Article 800 thereof), utilize copper conductors having TFN insulation for sizes #16 AWG and smaller, and type THHN or THWN for sizes #14 AWG and larger. Wires shall be run in electric metallic tubing or threaded metallic conduit as specified hereinafter in Part 3 of this Section.

D. Low voltage cables utilized for the control of lights, heaters, motors (or other power consuming equipment) by direct connection to line voltage relays that energize such equipment shall be run in electric metallic tubing or (where concealed from view), optionally as armored cable. Circuitry providing input to microprocessors (or other such devices) which in turn control power consuming equipment through line voltage relays shall be considered "data link" circuitry, and need not comply with the requirements of this paragraph.

E. Low voltage circuits intended for the distribution of voice or data shall utilize communications cables (complying with requirements of Article 800 of the National Electrical Code) having characteristics as follows:

1. Cables shall be of a fluoropolymer type, shall have adequate fire-resistant and low-smoke producing characteristics and shall be U.L. listed for plenum use (i.e., Type CMP), except as follows:

   a. Where run in conduit, they may be U.L. listed for general use (i.e, Type CM). Conduit shall be as specified hereinafter in Part 3 of this Section.

   b. Where run vertically from floor to floor through closets or shafts, U.L. listed riser cable (Type CMR) may be utilized without installation in conduit.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND TAGGING FOR ELECTRIC EQUIPMENT

A. Identify individually:-

1. Each secondary switchboard.

2. Each panelboard.

3. Each secondary distribution switch and circuit breaker regardless of whether separately mounted or grouped with others in a single housing.

4. Each wire or cable in each secondary feeder.

B. Each wire or cable in a feeder shall be identified at its terminal points of connection and in each pullbox, junction box and panel gutter through which it passes.

C. The nomenclature used to identify switchboards and panelboards shall designate the numbers assigned to them.

D. The nomenclature used to identify switches or circuit breakers shall:-

1. Where they disconnect mains or services designate this fact together with suitable differentiating nomenclature where more than one service or mains is involved.

2. Where they control feeders, designate the feeder number and the name of the load supplied.

3. Where they control lighting and appliance branch circuitry, designate the name of the space and the load supplied.

E. The nomenclature used to identify feeder wires and cables shall designate the feeder number.

F. Where circuit breakers or fuses are used in a series combination with downstream devices that are "series rated" and depend on the upstream devices for their interrupting rating, the enclosures for both the upstream and downstream devices must be marked "Caution - Series Rated System. Identical component replacement required." This shall be accomplished in the field utilizing readily visible engraved lamacoid nameplates.

G. Identification for switchboards and panelboards shall be by means of engraved lamacoid nameplates showing 1/4" high white lettering on a black background fastened to the outside face of the front.

H. Identification for distribution switches or circuit breakers shall be by means of the following:-

1. Where individually enclosed -- engraved lamacoid nameplates showing 1/8" high white lettering on a black background fastened on the outside front face of the enclosure.

2. Where in switchboards and panelboards without doors -- same as for individually enclosed.

3. Where in panelboards with doors -- typewritten directories mounted behind transparent plastic covers, in metal frames fastened on the inside face of the doors. Directories must be completely filled out indicating the nature of the load served.

I. Identification for the wires and cables of feeders shall be by means of wrap around "brady" type labels.

J. Device plates for local toggle switches, toggle switch type of starters, pilot lights and the like, whose function is not readily apparent shall be engraved with 1/8" high letters suitably describing the equipment controlled or indicated.

K. Phase identification letters shall be stamped into the metal of the bus bars of each phase of the main busses of switchboard and each panelboard. The letters shall be visible from at least one "normal posture" location without having to demount any current carrying or supporting elements.

L. Include new directories, nameplates, and tagging, as called for above on existing electrical work, where necessary, to identify modified existing electrical systems properly.

M. Equip the front face of all switchboards power centers pull boxes junction boxes and the like containing cables, busing or devices operating in excess of 600 volts with enamelled sheet metal "red on white" signs reading "DANGER--HIGH VOLTAGE."

N. Equip the exterior of the doors of switchboard rooms, vaults, cable chambers, metal screened spaces and the like containing electric power cabling, busing or equipment operating at voltages in excess of 600 volts, with enamelled sheet metal "red on white" signs reading "DANGER--HIGH VOLTAGE."

O. Equip all electric switchboard rooms, electric closets, metal screened spaces assigned to electric equipment and the like, with enamelled sheet metal "red on white" signs reading "Electrical Equipment Room -- No Storage Permitted." Signs shall be mounted at clearly visible locations within the rooms.

OA. Provide an engraved sign, permanently affixed to each individually mounted or switchboard mounted service switch supplying a fire pump. Sign to read "FIRE PUMP DISCONNECT MEANS" in 1" high letters. At each fire pump controller, provide a sign identifying the location of the disconnect means and key thereto.

P. Provide warning sign on or adjacent to any switching equipment whose blades may be alive when in the open position. Sign shall read "WARNING--LOAD SIDE OF SWITCH MAY BE ENERGIZED BY BACKFEED."

Q. Device plates for receptacles wired on emergency circuits shall each be engraved with the legend "emergency" in 1/8" high black letters and with the panel and circuit number from which it is supplied.

R. Identify each outlet box, junction box and/or cabinet for emergency circuitry by red paint or "Emergency System" tagging. Similarly, identify enclosures for generators, transfer switches, transformers and panels that are part of the emergency distribution system.

S. Identify each outlet box, junction box, and cabinet used in conjunction with empty raceway for wires of a future system by means of indelible markings on the inside denoting the system.

T. Prior to installing identifying tags and nameplates, submit their nomenclature for approval. Conform to all revisions issued by the Architect.

3.2 FIRE-STOPPING

A. Firestopping shall be provided for all penetrations of conduit, cable trays, etc., through fire-rated walls and floors and other fire-rated separations as follows:-

1. Excess space in framed openings through structural floors between conduits and concrete shall be grouted in with concrete to a depth of at least the thickness of the slab plus 2" minimum above the slab.

2. Conduit penetration through poured concrete or masonry walls shall be grouted in with concrete and provided with tight fitting escutcheon plates on both sides.

3. Conduit penetrations through fire-rated dry walls shall be with sleeves through the wall fitted with escutcheon plates on both sides with excess openings filled with fire stop material specificallly manufactured for the purpose.

4. Excess space within conduit sleeves or stubs through floor slabs or walls where low voltage cables pass through shall be filled with firestopping material specifically manufactured for the purpose.

5. Suitable external fireproof barriers of non-hygroscopic, arc resistant material shall be supplied for field installation at each point where bus ducts pass through a fire-rated slab or wall. Barriers shall be arranged to be snug fitting around the bus enclosure and the penetration such that all voids are effectively sealed.

6. Where cable trays pass through fire rated partitions or floors utilize fittings specifically manufactured for this purpose that includes multi-cable framed opening sleeves through the wall or floor and insert modules of firestop material through which the cable passes-all installed in accordance with manufacturer's recommendations. Include all additional components necessary for a complete firestop installation. The total cross sectional area of the firestop frame shall be equal to four (4) times the cross sectional area of the cable tray. The cable tray shall stop on each side of the wall or floor.

7. Utilize fire-rated fittings, as specified elsewhere for penetrations through floor slabs for supplying floor outlets.

B. All materials used for firestopping shall be approved for the purpose and the rating of the wall or floor and all methods employed shall meet with the approval of the local authorities.

C. Refer to architectural drawings and specifications for all locations of fire-rated walls and floors.

3.3 LIMITING NOISE PRODUCED BY ELECTRICAL INSTALLATION

A. Perform the following work, in accordance with field instructions issued by the Architect to assure that minimal noise is produced by electrical installations due to equipment furnished as part of the electrical work.

B. Check and tighten the fastenings of sheet metal plates, covers, doors and trims used in the enclosures of electrical equipment.

C. When located outside of equipment rooms, equip the enclosures of solenoid operated switching devices, and the like, with vibration mounts and non-combustible sound absorbing linings.

D. Remove and replace any individual device containing one or more magnetic flux path metallic cores (e.g., discharge lamp ballast, transformer, reactor, dimmer, solenoid) which is found to have a noise output exceeding that of other identical devices installed at the project.

3.4 MOUNTING HEIGHTS

A. Heights of all wall mounted outlets and equipment shall be in accordance with the following list. (Dimensions are above finished floor unless noted.)

1. Receptacle or telephone outlet in field constructed wall, partition or column unless otherwise specified below -- 18" to centerline.

2. Receptacle or telephone outlet in factory fabricated wall or partition, unless otherwise specified below -- Dimension determined by wall or partition construction.

3. Receptacle or telephone outlet in mechanical spaces electric switchboard rooms electric closets -- 5'-0" to centerline.

4. Receptacle outlet in garage and parking spaces -- 5'-0" to centerline.

5. Toggle switch outlet in field constructed wall partition or column -- 3'-10" to centerline.

6. Toggle switch outlet in factory fabricated wall or partition -- Dimension determined by wall or partition construction.

7. Individual motor starter -- 5'-0" to centerline.

8. Individual distribution system switching device (with or without overcurrent protection) -- 5'-0" to centerline.

9. Group mounted motor starters -- 6'-6" maximum to centerline of highest pushbutton or switching device handle requiring manual operation, 1'-0" minimum to bottom of lowest enclosure.

10. Group mounted distribution system switching devices -- 6'-6" maximum to centerline of highest switching device handle, 1'-0" minimum to bottom of lowest enclosure minimum to bottom of lowest enclosure.

11. Panelboard -- 6'-6" maximum to centerline of highest switching device handle.

12. Strip cabinet or other cabinet containing no switching devices -- 1'-0" minimum to bottom.

13. Bracket lighting outlets, except for "over door" -- 7'-6" to centerline.

14. Bracket lighting outlet over door -- as required to center outlet between top surface of door lintel and underside of ceiling.

15. Wall exit sign except for over door -- 7'-6" to centerline.

16. Exit sign over door -- As required to center sign between top surface of door lintel and underside of ceiling.

17. Outlet for any signal system device other than fire alarm station requiring manual operation -- 3'-10" to centerline.

18. Manual fire alarm station -- 3'-10" to centerline.

19. Outlet for any signal system visual or sounding device other than fire alarm visual device or visual/sounding device -- As required for device to clear underside of ceiling by 1"

20. Outlet for fire alarm visual device -- Bottom of visual device 80" AFF, except as otherwise noted.

21. Clock outlet -- As required for clock to clear underside of ceiling by 1"

B. Architectural drawings and field instructions issued by the Architect take precedence over the above list and shall be adhered to.

C. Mounting heights of pendant mounted lighting fixtures shall be as directed in the field by the Architect.

3.5 EXISTING ELECTRICAL WORK

A. The site and premises of the project contains existing electrical installations.

B. Except where it is integrated into a new installation, maintain all existing electrical work operating and intact by including all procedures and materials necessary to:-

1. Maintain the accessibility and functionally of all outlets manholes, handholes, junction boxes, pull boxes, wiring devices, panels, switchgear, fixtures and the like, that may be covered over or interfered with by the new construction work of all trades.

2. Maintain continuity in the existing light and power circuitry, communications and signal circuitry or other electric runs which must be disrupted to allow the new work of all trades to proceed.

3. Cut back and terminate at accessible points, in a safe manner, all live wiring made unnecessary or obsolete by the new construction work of all trades.

C. Specifications pertaining to equipment and devices, hereinafter included, apply to new work. Where it is required that items be made up with components which are both new and existing, it shall be interpreted that the specifications govern only as they are applicable to the new components.

D. Outages of existing electrical systems necessitated by the new construction work of all trades shall be in accordance with a schedule issued in the field by the Architect. Include all electric work, overtime labor and supervision necessary to adhere to this schedule.

E. Any existing electrical work which is pulled out or cut away in compliance with the above requirements shall be removed from the site as if it were rubbish.

F. Proper credit shall be given for all salvageable items.

G. During demolition procedures, provide all necessary protection for existing electric work required for reuse.

3.6 SUPPORTS

A. Support work in accordance with best industry practice and the following.

B. This project is located within a seismic zone requiring special provisions for the support and restraint of equipment and conduits as noted hereinbefore. Such provisions shall be incorporated in accordance with instructions included hereinbefore.

C. Include supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls and partitions where they are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.

D. In general, walls and partitions will not be suitable for supporting the weight of panelboards, dry type transformers and the like. Include supporting frames or racks extending from floor slab to ceiling slab for all such items unless specifically instructed otherwise by the Architect.

E. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free standing position.

F. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

G. No work intended for exposed installation in damp locations shall be mounted directly on any building surface. In such locations, flat bar members or spacers shall be used to create a minimum of 1/4" air space between the building surfaces and the work.

H. Support less than 2" trade size, vertically run, conduits at intervals no greater than eight feet. Support such conduits, 2" trade size or larger, at intervals no greater than ten feet.

I. Where they are not embedded in concrete, support less than 1" trade size, horizontally run, conduits at intervals no greater than seven feet. Support such conduits, 1" trade size or larger, at intervals no greater than ten feet.

J. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways or cables for support except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit in turn is securely supported from the structure within five inches of the fitting on two opposite sides.

K. Nothing shall rest on, or depend for support on, suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Vertical members which suspend the ceiling (together with their horizontal bracing which occurs above the ceiling), however, may be used for support, subject to the following criteria:

1. Supporting procedures shall be in accordance with the ceiling system manufacturer's instructions.

2. Supporting members for circuitry shall be rigid. Wires may not be used for such supports.

L. As a minimum procedure, support surface or pendant mounted lighting fixture:-

1. From its outlet box by means of an interposed metal strap, where weight is less than five pounds.

2. From its outlet box by means of a hickey or other direct threaded connection, where weight is from five to fifty pounds.

3. Directly from structural slab, deck or framing member, where weight exceeds fifty pounds.

M. As a minimum procedure, support light track (regardless of its length or weight) directly from structural slab, deck or framing member.

N. As a minimum procedure, support recessed lighting fixtures:-

1. From ceiling suspension members, as described above, where weight is eighty pounds or less. Fluorescent (or other discharge type) fixtures supported from ceiling suspension members shall be independently supported to the building structure by means of approved chains or wires attached to at least one point at each end of the fixture.

2. Directly from structural slabs, decks or framing members, where weight is more than eighty pounds.

O. Where fixtures and ceilings are such as to require fixture support from ceiling opening frames, include in the electric work the members necessary to tie back the ceiling opening frames to ceiling suspension members or slabs so as to provide actual support for the fixtures noted above.

P. In conjunction with lighting fixtures weighing less than forty pounds, the above restriction against supporting from suspended ceiling splines, runners or bars in the plane of the ceiling will be waived for ceilings which have been specifically approved for the weight and arrangement of fixtures being applied. Any support members, mechanical fastening means (i.e., bolts, screws or rivets), or other appurtenances, however, required to tie in or adapt to the fixtures and their ceiling opening frames (if any) to the ceiling in the approved manner shall be included as part of the electric work.

Q. As a minimum procedure, in suspended ceilings support small runs of circuitry (e.g., conduit not in excess of 1 inch trade size) from ceiling suspension members as defined above. Support larger runs of circuitry directly from structural slabs, decks or framing members.

R. Where support members must of necessity penetrate air ducts, include, in accordance with instructions issued in the field, airtight sealing provisions which allow for a relative movement between the support members and the duct walls.

S. Include in the electric work channel sills or skids for levelling and support of all floor mounted electrical equipment.

T. Where permitted loading is exceeded by direct application of electrical equipment to a slab or deck, include in the electric work proper dunnage as required to distribute the weight in a safe manner.

3.7 FASTENINGS

A. Fasten electric work to building structure in accordance with the best industry practice and the following.

B. As a minimum procedure, where weight applied to the attachment points is 100 pounds or less, fasten to building elements of:-

1. Wood -- with wood screws.

2. Concrete except precast and solid masonry -- with bolts and expansion shields.

3. Hollow construction -- with toggle bolts.

4. Solid metal -- with machine screws in tapped holes or with welded studs.

5. Precast concrete and steel decking or subfloor --with fastenings as specified below for applied weights in excess of 100 pounds.

C. As a minimum procedure, where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following:-

1. At field poured concrete slabs, utilize inserts with 18" minimum length slip-through steel rods, set transverse to reinforcing steel.

2. At precast concrete slabs utilize the factory embedded inserts included separate from the electric work.

3. At precast or existing concrete slabs utilize 24" x 24" x 1/2" steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.

4. At steel decking or subfloor for all fastenings, utilize through bolts or threaded rods. Exclude penetrations of cells. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or subfloor such hangers shall be utilized.

D. Where weight applied to building attachment points exceeds 300 pounds, conform to the following:-

1. Where building is steel framed, utilize suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitable welded or clamped to building steel. Utilize threaded rods or bolts to attach to bridging members.

2. Where building is concrete framed, abide by the specific instructions issued in the field by the Architect.

E. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.

F. For items which are shown as being ceiling mounted at locations where fastenings to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to building structural elements.

3.8 LOCATING AND ROUTING CIRCUITRY

A. All circuitry shall be run concealed except that it shall be run exposed:-

1. Horizontally at the ceiling of permanently unfinished spaces which are not assigned to mechanical or electrical equipment.

2. Horizontally and vertically in mechanical equipment spaces.

3. Horizontally and vertically in electric equipment rooms.

B. Concealed circuitry shall be so located that building construction materials can be applied over its thickest elements without being subject to spalling or cracking.

C. Concealment of circuitry by means of embedment in field poured building concrete will not be possible due to the fact that slabs are existing.

D. Circuitry run in non-structural field poured building construction fill may be located in any configuration which maintains their outside surfaces at least 1" away from any exposed (prior to finish application) surface of the concrete.

E. Circuitry run exposed shall be routed parallel to building walls and column lines.

F. Exposed circuitry located overhead shall be run in a completely accessible manner on the underside of all piping and ductwork.

G. Circuitry run in suspended ceilings shall be routed parallel to building walls, column lines, etc.

H. Circuitry shall be routed so as to prevent electric conductors from being subject to high ambient temperature. Minimum clearances from heated lines or surfaces shall be maintained as follows:-

1. Crossing where uninsulated----------3"

2. Crossing where insulated----------1"

3. Running parallel where uninsulated------3'-0"

4. Running parallel where insulated--------6"

I. Circuitry shall not be routed over or under a boiler except where special provisions for wiring through these specific high ambient temperature areas have been indicated.

J. Circuitry shall not be run in elevator or dumbwaiter shafts, hoistways, and the like. Where outlets for trail cables, pit lights, run by level lights, and the like, are involved, only the "final connection" outlet boxes themselves shall be located within or open into, the confines of the shaft.

K. Circuitry for miscellaneous systems indicated without notation as to location and routing shall be run as per the requirements and notations governing the adjacent light and power circuitry.

3.9 INSTALLING CIRCUITRY

A. The outside surface of circuitry which is to be embedded in cinder concrete shall be coated with asphaltum paint.

B. In runs of conduit or raceway limit the number of bends between cable access points to a total which does not exceed the maximum specified for the particular system. Where no such maximum is specified, limit the number to four right angle bends or the equivalent thereof.

C. In each conduit or raceway assigned for the separate from electric work or future pulling in of wires, include a nylon drag cord. In raceways 2" trade size and larger, the cord shall be pulled in utilizing a suitable brush, followed by an 85% diameter ball mandrel ahead of the cord in the pulling assembly. In the event that obstructions are encountered, which will not permit the drag cord to be installed, the blocked section of raceway shall be replaced and any cutting and patching of the structure involved in such replacement shall be included as part of the electric work.

D. Circuitry shall be arranged such that conductors of one feeder or circuitry carrying "going" current are not separated from conductors of the same feeder or circuitry carrying "return" current by any ferrous or other metal. Where not within raceways, all "going" and "return" current conductors of one feeder or circuit shall be laced together so as to minimize induction heating of adjacent metal components.

E. Sleeves used where circuitry is to penetrate water proof slabs, decks and walls, shall be of a type selected to suit the water condition encountered in the field.

F. Sleeves for passage of circuitry through slabs incorporating metal decking shall be set prior to the pouring of concrete. They shall be maintained sand filled during the pouring of concrete, the metal decking being cut through after concrete is hardened. Exclude all penetrations of cells.

G. The indicated conduit roughing system and specialty cast-in-floor raceway systems are existing and shall not be used to fulfill initial wiring requirements except as specifically noted.

H. Cutting and chasing, coring and patching of floor slabs and structural and non-structural fill as required for the installation of outlets shall be included as part of the electrical work.

I. Where outlets are to be supplied from a cast-in-place specialty raceway system, include all inserts, fittings, and miscellaneous as required. Connections shall not be made to the underside of the raceway system.

J. Except as specifically noted for outlets mounted on the existing cast-in-place raceway system, for floor and wall outlets in rental office space the required concealed-in-hung ceiling arrangement of circuitry shall conform to so-called "poke through system" criteria. These criteria are specified below, and constitute special qualifications to the general instructions to conceal the circuitry.

K. Criteria for the "poke through" system of circuitry are as follows:-

1. Circuitry shall be run in the hung ceiling space of the story which it serves or in the hung ceiling space of the story immediately below, utilizing openings cut through the floor slab when necessary.

2. The running of circuitry, at the story below the one served, shall be held to an absolute minimum, and shall be used only for tying floor outlets to their nearest adjacent outlets or for other such unavoidable purposes.

3. Circuitry serving a given story shall emanate from local supply or central facilities on the same story and none other.

4. Openings through floor slabs shall be cut, patched and "firestopped" as part of the electrical work. "Firestopping" shall include the filling in of excess opening spaces as well as the utilization of approved, fire-rated through-floor fittings for all floor outlets. These fire-rated fittings shall each be of the "dual service" type, complete with integral floor stanchion which can accommodate 120 volt and telephone and/or signal) circuitry and devices. All "firestopping" shall be performed as directed in the field. General instructions establishing cutting, patching and "firestopping" separate from the electric work are not applicable to the poke through system of circuitry.

5. Openings through floor slabs shall not be spaced closer together than two feet, and no more than one fire-rated fitting per 65 square feet of floor area in each span shall be utilized.

6. Openings through floor slabs shall not exceed 3" in diameter.

7. Connections to floor outlets at and the story on grade shall be made by embedding or chasing and grouting in circuitry in floor slab fill as here inbefore specified.

3.10 INSTALLING CONDUIT AND RACEWAYS

A. Install threaded metallic conduit in accordance with the following:-

1. Utilize factory manufactured elbows where field bends, made with industry standard minimum bending radii, will not fit the conditions.

2. Make all cuts square.

3. Ream out all burrs from ends prior to mounting in place.

4. Utilize threaded steel or malleable iron couplings to suit the conduit, for steel conduit and aluminum couplings for aluminum conduit and make all joints up tight for a continuous low impedance ground return.

   Where "one way" turning is not practical for making tight joints, utilize "erickson" type couplings. Exclude running threads and split couplings.

5. Make up tight to boxes, enclosures and cabinets utilizing double locknuts.

6. Utilize bakelite or plastic bushings at all terminations both free standing and within boxes, enclosures and cabinets.

7. Equip all conduits, which cross building expansion or control joints, with expansion fittings having flexible grounding bonds bypassing sliding parts. Arrange expansion fittings on concrete embedded conduit so that sliding action is not impeded.

8. During installation cap all runs left unfinished and unattended. Also, cap terminations of finished runs until wires and cables are to be pulled in. For capping, utilize fittings manufactured specifically for the purpose.

B. Install electric metallic tubing in accordance with the following:-

1. Utilize factory manufactured elbows where field bends, made with industry standard prescribed minimum bending radii, will not fit the conditions.

2. Make all cuts square.

3. Ream out all burrs from ends prior to mounting in place.

4. Couple sections together utilizing compression type couplings only.

5. Make up tubing to cabinets and boxes utilizing compression couplings only.

6. Equip all tubing runs, which cross building expansion or control joints, with expansion fittings having flexible grounding bonds bypassing sliding parts.

7. During installation, cap all runs left unfinished or unattended. Also cap terminations of finished runs until wires and cables are to be pulled in. For capping, utilize fittings manufactured specifically for the purpose. Exclude paper or wood plugs.

3.11 PULLING WIRES INTO CONDUITS AND RACEWAYS

A. Delay pulling in until the project has progressed to a point when general construction procedures are not liable to injure wires and cables, and when moisture is excluded from raceways.

B. Utilize nylon snakes or metallic fish tapes with ball type heads to set up for pulling.

C. In raceways 2" trade size and larger, utilize a pulling assembly ahead of wires consisting of a suitable brush followed by an 85% diameter ball mandrel. Submit certifications that mandrelling has been performed as specified.

D. Prior to installation, submit evidence that wires are new (in accordance with the definition of "New" as hereinbefore specified).

E. Leave sufficient slack on all runs of wire and cable to permit the secure connection of devices and equipment.

F. Include circular wedge-type cable supports for wires and cables at the top of any vertical raceway longer than 20 feet. Also include additional supports spaced at intervals which are no greater than those set forth as industry minimum standard. Supports shall be located in accessible pull boxes. Supports shall be of a non-deteriorating insulating material manufactured specifically for the purpose.

G. Pulling lubricants shall be products manufactured specifically for the purpose.

H. Slack on wires and cables located in cabinets and pull boxes shall be formed and set in place in groupings corresponding to their occupancy of raceways. They shall also be arranged, with insulators and supports provided where necessary, such that cable shims or other such temporary expedients do not have to be left permanently in place to prevent the wires and cables from shifting when covers or trims are removed.

I. At main switchboards lace outgoing cables to the cable racks and insulators provided. Lacing to be such that the cables are prevented from making contact with housing, framing, bussing or enclosure plates and also such as to assure maximum possible access to the rear studs of all overcurrent and switching devices.

3.12 SPLICING AND TERMINATING THE CONDUCTORS OF WIRES AND CABLES

A. Maintain all splices and joints in removable cover boxes or cabinets where they may be easily inspected.

B. Locate each completed conductor splice or joint in the outlet box, junction box, or pull box containing it, so that it is accessible from the removal cover side of the box.

C. Join solid conductors #8 AWG and smaller by securely twisting them together and soldering, or by using insulated coiled steel spring "wire nut" type connectors. Exclude "wire nuts" employing non-expandable springs. Terminate conductors #8 AWG and smaller by means of a neat and fast holding application of the conductors directly to the binding screws or terminals of the equipment or devices to be connected. Terminals and connectors shall be U.L. approved specifically for the application.

D. Join, tap and terminate stranded conductors #6 AWG and larger by means of solder sleeves, taps and lugs with applied solder or by means of bolted saddle type or pressure indent type connectors, taps and lugs. Where equipment or devices are equipped with set screw type terminals which are impossible to change, replace the factory supplied set screws with a type having a ball bearing tip. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector. Factory installed equipment or device terminals shall be of types U.L. approved specifically for the application.

E. Except where wire nuts are used, build up insulation over conductor joints to a value, equal both in thickness and diaelectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or by means of split insulating casings manufactured specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.

F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.

G. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.

H. Exclude all but solder or pressure indent type joints in conductors used for signalling or communications purposes.

I. Lugs for both ends of conductors used to make phase leg connections on the line side of a main service overcurrent and switching device shall be of the limiter type.

J. Splice, terminate and tap aluminum conductors in accordance with the following requirements which are in addition to those hereinbefore specified for copper conductors:

1. Utilize only non-indenting cold compression type lugs, taps and connectors.

2. Where it is not possible to use cold compression type lugs to connect conductors to equipment, terminate the aluminum cables in bi-metal pin connectors which each provides a flexible copper pigtail for insertion into the equipment mechanical lugs. Connectors shall be T&B "Bi-Pin" type, or other approved. Connectors which provide a solid copper plug will not be considered acceptable.

3. Before applying connectors or lugs, coat conductors with a sealing and oxidation inhibiting compound, specifically manufactured for making up aluminum electric joints. Then wire brush and make up the connection. Wire brushing and making up of the connection shall be done without removing compound.

3.13 FIREPROOFING WIRES AND CABLES

A. Beyond the termination of raceways, apply fireproofing over the unprotected insulation and/or splices of the following:-

1. Fire pump feeder cables wherever they extend beyond the termination of raceways.

2. All feeder wires and cables emanating from different secondary service connections or both normal and emergency supplies which, due to indications on the drawings or unavoidable field conditions are forced to enter the same unbarriered compartment of a cable chamber, cable pit, pull box or junction box.

B. Fireproofing of wires and cables shall be by means of a half-lapped layer of Scotch 77 fire and arc-proofing tape. The wrapped tape shall be sdecured by a band consisting of two layers of glass cloth electrical tape. Fireproofing shall be extended up into raceways. Fireproofing shall be applied in an overall manner to raceway groupings of conductors.

3.14 INSTALLING JUNCTION, PULL AND OUTLET BOXES

A. Apply junction and pull boxes in accordance with the following:-

1. Include pull boxes in long straight runs of raceway to assure that cables are not damaged when they are pulled in.

2. Include junction and pull boxes to assure a neat and workmanlike installation of raceways and metal clad cables.

3. Include junction boxes to house the splices to copper pigtails, at aluminum cable terminations, as called for elsewhere, when space for such splices is not available within the enclosure in which the cable is to be terminated.

4. Include junction and pull boxes to fulfill requirements pertaining to the limitations to the number of bends permitted in raceway between cable access points, the accessibility of cable joints and splices, and the application of cable supports.

5. Where the wires and cables following the same routing are indicated as running through separate pull boxes, it shall be understood that a segregation of the wires and cables is required. Separately indicated pull boxes may be incorporated into single boxes on condition that segregation is maintained by barriers of the type hereinafter specified.

6. Include all required junction and pull boxes regardless of indications on the drawings (which, due to symbolic methods of notation, may omit to show some of them).

B. Apply outlet boxes in accordance with the following:-

1. Unless noted below or otherwise specifically indicated, include a separate outlet box for each individual wiring device, lighting fixture and signal or communication system outlet component. Outlet boxes supplied attached to lighting fixtures shall not be used as replacements for the boxes specified herein unless they are specifically rated to accept "through circuit" building wires.

2. A continuous row of fixtures of the end-to-end channel type, designed for "through wiring," and wired in accordance with the specifications hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

3. A series of separate fixtures, designed for "through wiring," spaced not more than 2 feet apart, and interconnected with conduit or raceway and circuitry which is in accordance with the specifications hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

4. Connection to recessed ceiling fixtures supplied with pigtails may be arranged so that more than one, but not more than four, such fixtures are connected into a single outlet box. When adopting this procedure:-

   a. Utilize an outlet box no smaller than 4-11/16" square by 2-1/8" deep.

   b. Allow no fixture to be supplied from an outlet box in another room.

5. Multiple local switches indicated at a single location shall be gang mounted in a single outlet box.

6. Include all required outlet boxes regardless of indications on the drawings (which due to symbolic methods of notation, may omit to show some of them).

7. Regardless of any indications on the drawings, flush wall mounted outlet boxes shall not be set back-to-back in fire rated walls or partitions, even if they are displaced vertically. Such outlets shall be offset horizontally by 2'-0" or as otherwise required to maintain the fire rating.

8. Exclude "through-the-wall" collar type outlet boxes for flush devices indicated back-to-back in non-fire rated partitions or walls. Where necessary to accommodate box depths, outlets shown back-to-back shall be horizontally offset.

C. Install junction boxes, pull boxes and outlet boxes in accordance with the following:-

1. Exclude surface mounted outlet boxes in conjunction with concealed circuitry.

2. Exclude unused circuitry openings in junction and pull boxes. In larger boxes each such opening shall be closed with a galvanized sheet steel plate fastened with a continuous weld all around. In small outlet type boxes, utilize plugs as specified for such boxes.

3. Close up all unused circuitry openings in outlet boxes. Unused openings in cast boxes shall be closed with approved cast metal threaded plugs. Unused openings in sheet metal boxes shall be closed with sheet metal knock-out plugs.

4. Pack "through the wall" collar type outlet boxes with a sound deadening, non-hardening, non-hygroscopic, non- combustible, high dielectric stuffing material manufactured specifically for the purpose.

5. Equip outlet boxes used in circuitry operating in the range of 250 to 300 volts to neutral with barriers to separate wiring devices connected to different phase legs.

6. Outlet boxes for switches shall be located at the strike side of doors. Indicated door swings are subject to field change. Outlet boxes shall be located on the basis of final door swing arrangements.

7. Boxes and plaster covers for duplex receptacles shall be arranged for horizontal mounting of the receptacle.

8. Equip outlet boxes used for devices which are connected to wires of systems supplied by more than one set of voltage characteristics with barriers to separate the different systems.

D. Barriers in junction and pull boxes of outlet size shall be of the same metal as the box.

E. Barriers in junction and pull boxes which are larger than outlet size shall be of polyester resin fiberglass of adequate thickness for mechanical strength but in no case less than 1/4 inch. Each barrier shall be mounted, without fastenings, between angle iron guides so that they may be readily removed.

3.15 INSTALLING CIRCUITRY AND EQUIPMENT IN HAZARDOUS LOCATIONS

A. Refer to appropriate paragraphs of Part 2 of this Section for installation.

3.16 INSTALLING WIRING DEVICES

A. Install wiring devices in accordance with the following:-

1. Duplex receptacles shall be mounted horizontally or vertically as directed.

2. Maintain a consistent orientation for neutral connections at all receptacles of an identical polarized configuration. Use the silvered terminal for neutral on each receptacle supplied with same. Where a neutral connection is required at a receptacle having no silvered terminal, apply white paint in the field to identify the terminal used for the purpose.

3. Provide plates for all wall mounted devices.

4. Provide stanchions as standard mounting for all floor mounted receptacles.

5. Obtain final field instructions from the Architect prior to locating devices whose plates flush floor outlet fittings stanchions or visible parts have been specified in materials, colors or finishes which differ.

6. For each required non-standard convenience receptacle or special purpose power supply receptacle, furnish one grounding type attachment plug to fit it. In conjunction with receptacles having threaded covers, plugs shall be equipped with matching threaded bells or nozzles. As part of the electric work, connect the attachment plug to the cord of the associated appliance provided separate from the electric work.

7. For each required non-standard convenience receptacle or special purpose power supply receptacle, provide a bonding jumper from its grounding terminal to its outlet box.

8. In conjunction with flush floor outlet fittings for receptacles, plug protection rings and blanking caps are to be installed or deposited for reserve supply as directed.

3.17 INSTALLATION OF CIRCUITRY FOR MISCELLANEOUS LOW VOLTAGE SYSTEMS

A. Comply with requirements described in applicable subsections of this Section (16050). In particular, note the following circuitry requirements for low voltage systems:

1. Wiring for miscellaneous low voltage systems may be run without conduit - subject to the approval of the local authorities - except where prohibited by other sections of these specifications or by indications on the drawings.
2. Where conduit is required, it shall be steel electric metallic tubing (EMT), except that it shall be galvanized intermediate steel conduit where located within 8'-0" of the floor in mechanical spaces (or is otherwise exposed to mechanical damage), or is intended for embedment in concrete.

3. Wires and cables shall have characteristics - in compliance with Articles 725 and/or 800 (as applicable) of the National Electrical Code - as described elsewhere in the specifications or drawings for this project, and shall be U.L. listed in accordance therewith.

4. Where wires and cables are permitted to be run without conduit, they shall be independently supported from the building structure or ceiling suspension systems at intervals not exceeding four feet on center, utilizing cable supports specifically approved for the purpose. Wires and cables shall not rest on or depend on support from suspended ceiling media (tiles, lath, plaster, as well as splines, runners or bars in the plane of the ceiling), nor shall they be supported from pipes, ducts or conduits. Where cables are bundled together, separate bundles shall be provided separately for each type of cabling and separately for each independent system. Bundling and/or supporting ties shall be of a type suitable for use in a ceiling air handling plenum regardless of whether or not installed in a plenum.

5. Cables shall be tagged or labeled at each termination point and in each intermediate junction box, pull box or cabinet through which they pass.

6. Comply with applicable requirements for locating and routing circuitry, for installing circuitry, and for fire-stopping as described in other sub-section of this Section (16050).

3.18 INSTALLATION OF SEISMIC RESTRAINTS

A. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all submittal data.

B. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

C. Equipment shall be restrained as indicated in the table at the end of this specification.

D. Additional Requirements

1. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators, and restraints.

2. Spring isolators shall be installed after all equipment is installed without changing equipment elevations.

3. After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.

4. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment's movement shall be free in all directions.

5. All electrical connections to isolated equipment such as transformers and generators shall be in flexible conduit.

6. Use wedge type expansion bolts to bolt the base to the structure.

7. All equipment specified to receive seismic support shall be restrained per the table at the end of this section.

8. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted, or welded to the structure to comply with the required acceleration. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.

9. Lighting fixtures shall be seismically restrained in accordance with the following:

   a. All lighting fixtures mounted in the paths of egress, and all emergency fixtures and exit signs throughout the building shall be provided with seismic restraints.

   b. Lighting fixtures recessed into suspended ceilings shall be supported from the ceiling structure by not less than two earthquake clips, or other approved supports, each capable of supporting 50 % of the fixture weight.

   c. Lighting fixtures surface mounted on the underside of suspended ceilings shall be provided with at least two supports, each independently connected to the slab above with cable type restraints as described hereinbefore for suspended systems and each capable of supporting 100 % of the fixture weight.

d. Pendant mounted lighting fixtures shall be supported from the slab above utilizing approved fixture hangers designed to permit a swing of at least 20° in any direction without damage to the fixture, hangers, or structure. Each support shall be capable of supporting 100 % of the fixture weight. If there are obstructions preventing the free swing, provide additional support bracing to restrain 50 % of the fixture weight. Pendant mounted fixtures below suspended ceilings shall be supported at the ceiling level and shall have cable ties to the slab above.

10. All horizontally suspended cable trays, and conduit systems shall use restraints for non-isolated suspended systems. Spacing of seismic bracing shall be according to table below. All bus ducts and cable trays passing through floors shall be bolted at each floor level or secured above and below each floor with riser clamps. This restraint shall be in addition to the spring type hangers specified in Section 16400.

SEISMIC BRACING TABLE

EQUIPMENT	ON CENTER SPACING		WITHIN EACH CHANGE OF DIRECTION
	TRANS-	LONGITU-	
CONDUIT	40 FEET	80 FEET	10 FEET OR 15 DIAMETERS
CABLE TRAY	40 FEET	80 FEET	10 FEET

11. For all seismically supported trapeze supported conduit, the individual conduits shall be transversely and vertically restrained to the trapeze support at the designated restraint locations. Restrain at least every third trapeze hanger transversely and every fifth one longitudinally as well as the trapeze on both sides of every change of direction.

12. For overhead supported equipment, overstress of the building structure must not occur. Bracing may occur from:

    a. Flanges of structural steel beams.

    b. Upper truss chords in bar joists.

c. Cast in place or drilled and shielded inserts in concrete structures.

13. Where conduits pass through cored or sleeved holes, the holes shall be a maximum of 2" larger than the conduit O.D. Pack the space with fireproofing material. No additional horizontal seismic bracing is required at these locations.

14. All non-isolated floor or wall mounted equipment such as substations, switchboards, panelboards, etc. which require restraint shall use restraint for rigid attachment. For floor mounted transformers up to and including 300 kva, use isolators with a 0.30" deflection and rigid attachment seismic restraints. For larger transformers, provide a calculation for the isolators and restraints required. Where base anchoring of equipment such as UPS's or switchboards is insufficient to resist seismic forces, additional restraints for suspended, non-isolated equipment shall be located above the unit's center of gravity to suitably resist "G" forces specified.

15. Emergency generators shall be a "factory package" mounted on a rigid base consisting of a full length skid or rail of structural steel on each side and cross bracing members at each end. An additional auxiliary matching rigid base shall be furnished and installed anchored to the floor as dunnage. The emergency generator set shall be resiliently isolated from the building structure or grade by means of bare stable spring isolators (with 1.50" deflection and 0.10" deflection respectively) mounted between the rigid base of the generator and the matching auxiliary base. Provide seismic restraints for rigid attachment.

E. Inspection

1. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the manufacturer shall be submitted in writing to the architect/engineer indicating that all systems are installed properly and in compliance with the specifications. The report shall identify those areas that require corrective measures or certify that none exist. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in this report.

END OF SECTION

SECTION 16400 - SERVICE AND DISTRIBUTION (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Service and distribution equipment, materials and installation (at 600 volts and below) as described.

1.2 RELATED WORK

A. Section 16050 - Basic Electric Materials, Methods and Requirements.

1.3 REFERENCES

A. New York City Electrical Code.

B. New York City Building Code (and Reference Standards)

C. NEMA PB-1 - Panelboards.

D. NEMA AB-1 - Molded Case Circuit Breakers.

E. NEMA KS-1 - Enclosed Switches.

F. NEMA PB-2 - Dead Front Distribution Switchboards.

G. UL 891 - Dead Front Switchboards.

H. ANSI/NEMA ST-20 - Dry Type Transformers.

1.4 QUALITY ASSURANCE

A. In order to define requirements for quality and function, product specifications designate manufacturers. Equivalent or better products of other unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in Section 16050.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 MAIN SWITCHBOARDS FOR LIGHT AND POWER

A. Main switchboards for light and power are existing except for additional section shall be per N.Y.C. and PA requirements.

2.2 PANELS FOR LIGHT AND POWER

A. Panels shall consist of factory completed deadfront assemblies of back pans, main busses, overcurrent and switching units, sheet metal cabinets and trims.

AA. All overcurrent protection and switching devices shall be U.L. listed as suitable for the termination of 75°C conductors, sized in accordance with their 75°C ampacity ratings. Devices shall be specifically identified accordingly and shall bear the designation "60°/75°C" or "75°C", regardless of whether incorporated in panelboards, switchboards or other assemblies or whether individually mounted.

B. Where indicated as power or distribution panels, they shall be of the convertible type.

C. Bus bars shall be of copper or aluminum having current capacities as indicated and sized for such capacities in accordance with Underwriter Laboratory standards. Unless otherwise noted, full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction.

CA. The neutral buses of 120/208 volt panels supplying "harmonic-rich" line-to-neutral loads shall have ampacities larger than those of the phase legs in such panels in accordance with the following criteria:

1. In no case shall the neutral bus ampacity of any panel supplied by a feeder with a neutral conductor which is larger than the phase conductors shall be less than the lesser of:

   a. The ampacity of the neutral conductor of the feeder supplying the panel.

   b. Twice the ampacity of the upstream overcurrent device protecting the feeder supplying the panel.

2. The above requirements for the sizing of panel neutral buses shall override any indications on the drawings that smaller neutral buses are acceptable.

2A. Neutral buses shall be equipped with lugs capable of accepting single conductors (i.e., not paralleled) of an ampacity equal to the neutral bus rating (except where the neutral bus rating exceeds 400 amps).

3. If required by manufacturer in order to comply with increased neutral bus sizing criteria specified above, increase phase leg bussing, as well.

4. Refer to the light and power riser diagram or to other electrical drawings to determine which panels - if any - are supplied by feeders having "over-sized neutrals" and therefore require up-sizing of the panel neutral bus.

D. A ground bus shall be provided for each panel. Each ground bus shall be of the same material as the phase and neutral buses. For panels supplying isolated ground receptacles and/or where otherwise directed, the ground bus shall be insulated from the cabinet of the panel.

E. Their cabinets shall be fabricated from industry standard gauge galvanized sheet steel with corners lapped and riveted, or fastened by approved methods.

F. The inside and outside of their trims shall be factory painted with one rustproofing primer coat and one finish coat. The finish paint shall be of a type to which field applied paint will adhere.

G. Their cabinets and trims shall be suitable for the required mounting trims shall be screw fastened to cabinets and shall be of a type that is self-supporting on cabinets after screws have been removed. Trims for flush panels shall overlap cabinets by at least ½" all around.

H. Cabinets and trims for lighting and appliance panels shall accommodate and conform to the following limiting dimensions:-

MOUNTING	NOMINAL VOLTAGE	MAIN DEVICE	MIN.WIDTH WIRING GUTTER ON EACH SIDE	MAX. OVER-ALL WIDTH INCL. TRIM	MAX.OVER-ALL DEPTH
Flush	120/208	None	5-3/4"	24"	4-3/4"
Flush	277/480	None	5-3/4"	24"	6"
Surface	Any	None	5-3/4"	24"	6"

MOUNTING	NOMINAL VOLTAGE	MAIN DEVICE	MIN.WIDTH WIRING GUTTER ON EACH SIDE	MAX. OVERALL WIDTH INCL. TRIM	MAX.OVERALL DEPTH
Flush	Any	Circuit Breaker	5-3/4"	24"	6"
Surface	Any	Circuit Breaker	5-3/4"	24"	6"
Flush	Any	Fused Switch	5-3/4"	24"	9"
Surface	Any	Fused Switch	5-3/4"	24"	9"

I. Any cabinet for a power or distribution panel shall (regardless of the actual devices required to be in it) have a width and a depth adequate for a three pole branch device equal in rating to the panel mains. In no case shall the cabinet be wider than 42" or deeper than 18".

J. Where feeder cables supplying the mains of a panel are carried through its cabinet to supply other electrical equipment, the cabinet shall be so sized as to include a wiring space having at least five times the cross sectional area of the through feeder cables. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly.

K. Where wires or cables are used within panelboards to make up internal connections (factory installed or otherwise) such wire or cable shall have copper conductors only.

L. Where indicated or as required to assure ready accessibility of top switching and overcurrent device, they shall be arranged as multiple adjacent sections. A single overall cabinet shall be supplied for the multiple adjacent sections which constitute one panel. 1/4 minimum thickness plastic barriers having adequate angle iron framing support all around shall be included between sections. The entire assembly shall be such as to include wiring gutter space for each section as if it were an individual panelboard. Common bussing shall be arranged for adjacent sections unless there is indication that the individual sections are to be separately supplied. Sub-feed lugs with full capacity cable taps to adjacent panel sections will be accepted as the bussing method.

M. Switch and fuse units incorporated as part of panelboards shall be equipped with factory installed rejection clips to restrict fuses to types specified in section entitled "Selection of Overcurrent Protection and Switching for Light and Power". Modify or replace in field any incorrect fuse clips.

N. 120/208 volt lighting or appliance panels shall each be equipped with through feed lugs to permit the addition of panel section initially or in the future.

O. Hinged doors covering all switching device handles shall be included in all panel trims except that power and distribution panels having individual metal clad externally operable deadfront units, except that power and distribution panelboards having individual metal clad externally operable deadfront units in spaces reserved for mechanical and electrical equipment shall be supplied without such doors.

P. Doors in panelboard trims shall conform to the following:-

1. In making switching device handles accessible, doors shall not uncover any live parts. Doors shall have flush type paracentric cylinder locks and catches, except that doors over 48" in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Two keys shall be supplied for each lock and each key shall open all panelboards. Locks and keys shall conform to a "standard keying policy" as directed.

2. Doors over main units shall be separate from those over branch units.

3. Except for panelboards in spaces reserved for mechanical and electrical equipment, doors making access to switch handles in panelboards, having switch and side fuse units, shall not expose the fuses. Door-in-door construction shall be used.

Q. Where indicated, lighting or appliance panels shall be of the "column" type. Each column type panel shall meet all above requirements except that it shall consist of an integral narrow panel and trough extension, and a neutral housing and circuiting pull box, all constructed as an Underwriters approved assembly conforming to the following dimensions:-

1. Single side wiring gutter -- 2" minimum width.

2. Panel and extension through width -- 9" maximum; depth -- 6" maximum.

3. Neutral housing pull box -- width 20" maximum; height 15" maximum; depth 6" maximum.

R. Provide "lock-on" clips for the toggle handles of 5 percent of the branches in all lighting and appliance panels. Apply these clips to circuits supplying emergency battery units, night lights, clocks, fan coil units and others as directed in the field.

RA. Furnish handle padlock attachments for 5 percent of the branches in lighting and appliance panels, and padlocks (with key) for 10% of these padlock attachments, but not less than 10 locks. Apply the padlock attachments to circuits (as directed in the field) for which the branch circuit device must be lockable in the "off" position in order to provide code-approved disconnect means.

S. Submit certification that each panelboard has withstood, without breakdown, a factory dielectric ("Hi-Pot") test consisting of a one minute application of 60 cycle A.C. test voltage applied between phase legs and from each phase leg to enclosure. The applied test voltage shall have an RMS value of at least twice the line to line system voltage to which the panelboard is to be applied, plus one thousand volts (minimum 1500 volts).

T. Where "spaces only" for overcurrent protection and switching devices are called for in a panel, its main bus, and backpan, as well as its cabinet and trim, shall be extended to accommodate these spaces.

U. Each panelboard shall bear a manufacturer's label stipulating its short circuit current rating. Panels shall be "fully rated" or "series connected rated" as indicated below.

V. Short circuit ratings for secondary distribution systems derived from Utility Co. "primary to 277/480 volt" transformer(s) shall equal or exceed the following:-

1. 277/480 (265/460) and 480 (460) volt power and distribution panels shall be "fully rated" for not less than 200,000 amps when used in conjunction with appropriate current limiting fuses.

2. 277/480 (265/460) volt lighting and appliance panels shall be "series connected rated" for not less than 150,000 amps where used in conjunction with appropriate upstream current limiting fuses, or optionally with main or upstream current limiting circuit breakers.

3. 120/208 volt power or distribution panels shall be fully rated for not less than 22,000 amps.

4. 120/208 volt lighting or appliance panels shall be "fully rated" for 10,000 amps except that panels supplied from transformers 225 KVA and larger shall be "fully rated" or "series connected" rated for not less than 22,000 amps.

W. Panels shall be manufactured by Westinghouse, General Electric, Square D, Siemens (ITE), Lincoln Electric, all city, Metropolitan Switchboard or other approved.

2.3 INDIVIDUALLY MOUNTED OVERCURRENT & SWITCHING DEVICES

A. Enclosures for individually mounted overcurrent and switching devices for light and power shall be rustproofed code gauge sheet steel NEMA Class I.

B. Except where for electrically operated devices, they shall have external handles for operating the enclosed devices, complete with door interlock and factory or field installed provisions for padlocking in either the open position or the closed position.

C. Their device operating handles shall be front or side type as required for adequate hand access and clearance and to accommodate flush or surface mounting requirements.

D. Their operating handles shall be equipped with padlocks and keys in accordance with field instructions issued by the Architect.

E. Factory or field installed rejection clips shall be provided for each fusible switch to restrict fuses to types specified in section entitled "Selection of Overcurrent Protection and Switching". Modify or r

EA. Enclosure construction shall be such that where 100% rated overcurrent protection and switching devices have been specified, such devices will be able to carry 100% of their rated load continuously when mounted in its enclosure.

F. Each enclosure for an individually mounted overcurrent and switching device which functions as a service disconnect shall be equipped with an Underwriters label attesting to its suitability as service entrance equipment.

FA. For each individually mounted overcurrent protection and switching device (OCD) larger than 800 amps which is used as a service disconnect on a 277/480 (265/460) volt service, provide a service ground fault tripping system, separately mounted in a NEMA 1 enclosure adjacent to the OCD. Include all required sensors, ground fault relays, auxiliary relays, test switches and other required components, complete with power supply connection and all necessary interwiring.

FAA. Solid neutral connections for 120/208 volt overcurrent protection and switching devices supplying "harmonic-rich" line to neutral loads, shall have ampacities equal to the neutral conductor ampacity of the feeder or 200% of the phase conductor ampacity, whichever is less. Such "oversized" neutral connections shall be provided for each overcurrent protection and switching device supplied by a feeder or branch circuitry run whose neutral conductor exceeds the phase conductor. Where not available from manufacturer with increased neutral, increase device size as required.

G. Each fusible switch shall bear a manufacturer's label stipulating its short circuit current as 200,000 amps, when used with appropriate fuses.

GA. All overcurrent protection and switching devices shall be U.L. listed as suitable for the termination of 75°C conductors, sized in accordance with their 75°C ampacity ratings. Devices shall be specifically identified accordingly and shall bear the designation "60°/75°C" or "75°C", regardless of whether incorporated in panelboards, switchboards or other assemblies or whether individually mounted.

2.4 SELECTION OF OVERCURRENT PROTECTION AND SWITCHING FOR LIGHT AND POWER DISTRIBUTION (PROGRAM UNIV-SWF)

A. Devices shall have voltage ratings suitable for the supply characteristics to which they are applied.

B. Short circuit current ratings, and the manufacturer's labels attesting to these ratings (based on U.L. listings), will be required for overcurrent protection and switching devices, where they are individually mounted (as fused switches or as fused switch bus duct plug-in devices), and for the equipment assemblies when they are incorporated in panels, switchboards, etc. Such ratings shall be in accordance with the following:-

1. In order to insure that they are at least equal to the available fault current, minimum ratings have been specified herein for the individual overcurrent device types, and in the pertinent sections for panelboards, and other assemblies or devices. Where "series connected ratings" have been specified for circuit breaker type panelboards (see appropriate specification section), these minimum ratings are in general based on the use of upstream fuses which have been specifically tested with the circuit breakers, and have been U.L. listed accordingly.

2. Where such fuse-circuit breaker series ratings are not available from a particular manufacturer, a current limiting circuit breaker may be utilized as the upstream device in order to obtain the required series rated. Such current limiting breakers shall be incorporated as main devices in the panelboards, as part of upstream panelboards, metering assemblies, or as individually mounted devices or bus duct plug-in devices, as the case may be. Where the required ratings can be met with main or upstream non-current limiting breakers having appropriate interrupting capacities, as approved by U.L., such arrangements will also be considered acceptable.

C. In advance of, or in conjunction with, the submission of shop drawings for approval, provide data defining in detail how the required short circuit current ratings specified elsewhere in these specifications will be achieved with the equipment being furnished. The data shall, in narrative or graphic fashion, fully define how the various devices, individually, or in combination, comply with the "fully rated" or "series connected" short circuit current requirements. Include certifications from the manufacturer as to the U.L. approvals for these ratings for all proposed equipment.

CA. All overcurrent protection and switching devices shall be U.L. listed as suitable for the termination of 75°C conductors, sized in accordance with their 75°C ampacity ratings. Devices shall be specifically identified accordingly and shall bear the designation "60°/75°C" or "75°C", regardless of whether incorporated in panelboards, switchboards or other assemblies or whether individually mounted.

D. Select overcurrent protection and switching devices as follows:

CATEGORY OF APPLICATION		ACCEPTABLE DEVICE TYPES (see legend below)
Main or branch unit in 265/460 (277/480) volt distribution panel or power panel		SW-QMQB/CF except CLCB-MC if needed in order to meet the specified series connected rating of downstream lighting or appliance panel.
Main unit in 265/460 (277/480) volt lighting or appliance panel		CB-SMC, except CLCB-MC if needed in order to meet the specified series connected rating of the panel.
Branch unit in 265/460 (277/480) volt lighting or appliance panel		CB-SMC
Main or branch unit in 120/208 volt distribution or power panel		CB-SMC
Main or branch unit in 120/208 volt lighting or appliance panel.		CB-SMC
Individually mounted unit	(0-1200 amps)	SW-QMQB/CF except CLCB-MC if needed in order to meet the specified series connected rating of downstream lighting or appliance panel.

CATEGORY OF APPLICATION		ACCEPTABLE DEVICE TYPES (see legend below)
Individually mounted unit without overcurrent protection	(0-1200 amps)	SW-QMQB
	(above 1200 amps)	SW-BP
Bus duct plug-in device		SW-QMQB/CF except CLCB-MC if needed in order to meet the specified series connected rating of the downstream lighting or appliance panel.
Motor starting fusing		CF

E. Explanation of abbreviations used above is as follows:-

ABBREVIATION	DESCRIPTION
SW-BP	Distribution switch; bolted pressure type.
SW-QMQB	Distribution switch; quick-make, quick-break type.
/	Fusible -- fused with.
CF	Cartridge fuses.
CB-SMC	Circuit breaker, standard molded case type.
CLCB-MC	Current limiting circuit breaker; molded case type.

F. Select bolted pressure type distribution switches in accordance with the following:-

1. They shall have copper current-carrying elements having silver plated contact surfaces.

2. They shall have blade locks to prevent them from opening under short circuit stresses and a mechanism which produces initial contact pressure on the jaws in addition to final bolted pressure when they are closed.

3. They shall be capable of interrupting at least 12 time their rating without damage in accordance with NEMA and U.L. performance standards.

4. They shall have auxiliary renewable arcing contacts which "make" before and "break" after main current-carrying elements function.

5. They shall be equipped with operating mechanisms which incorporate manual closing and tripping.

6. They shall be designed for use with Class "L" fuses.

7. They shall be 100% rated when mounted in an enclosure, in accordance with U.L. test procedures.

I. Select quick-make, quick-break type distribution switches in accordance with the following:-

1. They shall equal or exceed the performance required for NEMA type H.D. horsepower rated switches.

2. They shall have arc quenchers and circuit breaker type pressure contacts.

3. Where intended for panelboards or switchboard mounting, they shall be of the "bolted-in" type.

4. Where of the fusible type, they shall be designed for use only with Class "J" fuses up to 600 amps, and "Class L" fuses above 600 amps, and shall incorporate factory installed clips designed to insure the use of proper fuses. Coordinate to insure that fuses supplied for the project match these fuse gaps.

J. Select cartridge fuses in accordance with the following:-

1. Regardless of the actual available fault current they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical deliverable at the line side of the fuse.

2. Except as noted hereinafter, in sizes up to 600 amps, they shall be of the Class "J" time delay type, capable of carrying 500% of rated current for not less than 10 seconds and U.L. listed as a "Class J" fuse. Fuses shall be Shawmutt Type "AJT", Bussmann Type "LPJ", or other approved. Approval is contingent on certified test data demonstrating full compliance with the following requirements:-

a. Fuse carries 500% of rating for at least 10 seconds.

b. Fuse suitable for motor feeders when applied at 150% of motor full load current.

c. Fuse selectivity with downstream fuses shall be:-

1) 2:1 with "J" time delay

2) 3:1 with "RK-5" time delay

3) 2:1 with "RK-1" time delay

3. Where intended for use in motor starters (individual, or in motor control centers) they shall be of the dual element time delay type, U.L. listed as "Class RK-5", and capable of carrying 500% of rating for at least 10 seconds. Utilize "Class RK-1" time delay fuses where required to insure coordination with upstream fuses.

4. Except as noted hereinafter, in sizes over 600 amps, they shall be of the current limiting type, U.L. listed as "Class L".

5. Where protecting a feeder or tap supplying a single large motor or transformer, fuses in the range of 800 to 2000 amps shall have special "Class L" time delay characteristics equal to Shawmutt Type "A4BT" or Bussmann Type "KRP-C" fuses.

6. Where protecting a feeder or tap supplying a single large motor or transformer, fuses in the range of 2500 to 4000 amps shall have special "Class L" time delay characteristics equal to Bussmann Type "KRP-C" fuses.

7. They shall be suitable for application to fuse gaps which reject other types of fusing. Coordinate with supplier(s) of all fusible switch units (in panels, switchboards, etc.) for the project to insure that fuse gaps match the specified fuse types.

K. Select standard, molded case type circuit breakers in accordance with the following:-

1. They shall consist of manually operated quick-make, quick-break mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole, all enclosed in molded phenolic plastic cases.

2. Their tripping units shall be of the "thermal magnetic" type having bimetallic elements for time delay overload protection, and magnetic elements for short circuit protection.

3. They shall be manually operable by means of toggle type operating handles having "tripped" positions midway between the "on-off" position.

4. They shall each be contained in an individual case enclosing only the number of poles required for the particular breaker.

5. Where no frame sizes are indicated, their interrupting capacities (in RMS symmetrical amperes) shall be not less than the following:-

Where Installed	Interrupting Capacity
265/460 (277/480) volt lighting or appliance panels.	14,000A
120/208V lighting or appliance panel	10,000A

6. Where frame sizes are indicated, the interrupting capacities shall be no less than the following:-

INDICATED FRAME SIZE	MINIMUM ACCEPTABLE SYMMETRICAL AMPERES INTERRUPTING RATING IN RMS AMPERES
100	22,000
225	22,000
400	42,000
600	42,000
800	42,000

7. The minimum interrupting capacity in symmetrical RMS amperes of the circuit breakers intended for use in panelboards shall be as noted above. Where necessary in order to provide the U.L. approved "series connected" short circuit panel ratings specified elsewhere, (see "Panels for Light and Power specification) breakers with higher interrupting capacities shall be provided as required.

8. They shall be of the "bolted-in" type.

9. Where necessary to accommodate other requirements (e.g., panelboards to be convertible type), their frame sizes shall be increased to conform to such requirements, frame sizes being indicated only as a reference to the minimum acceptable interrupting ratings noted above.

10. They shall have interchangeable trips in all sizes for which such trips are manufactured as standard.

11. They shall be equipped with ambient temperature compensating features extending to 40°C.

12. They shall be equipped with 5 milliamp sensitivity ground fault interrupting features where so indicated, and/or where they supply standard convenience receptacles in bathrooms and other such code mandated locations and with 30 milliamps sensitivity G.F.I. features where they supply piping tracing cables or snow melting cables or gutter de-icing cables or HWAT cables.

13. Where single pole in trip sizes 20 amps or less, they shall be rated for switching duty.

L. If required to provide "series connected" ratings (as specified elsewhere) where fuse-breaker ratings have not been listed by U.L., selected molded case type current limiting circuit breakers in accordance with the following:-

1. In frame sizes up to 400 amps, they shall each be of the fuseless type and have an interrupting capacity of 200,000 amps symmetrical at 120/208 (240) volts and 150,000 amps symmetrical at 265/460 (277/480) volts.

2. In frame sizes larger than 400 amps, they shall each consisting of a molded case circuit breaker with a current limiting fuse connected in each pole, as noted below:-

a. Their fuses shall be equipped with release buttons arranged to trip open the latches of their circuit breaker elements.

b. Sizing of the fuses shall be as directed.

c. Each shall have its fuses and breaker elements integrally mounted in a single overall molded phenolic plastic case.

3. Their breaker elements shall consist of manually operated, quick-make, quick-break, mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole.

4. Their breaker tripping units shall be of the "thermalmagnetic" type having bimetallic elements for time delay overload protection, and magnetic elements for short circuit protection.

5. They shall be manually operable by means of toggle type operating handles having "tripped" positions midway between the "on-off" position.

6. They shall be of the "bolted-in" type.

7. They shall have interchangeable trips.

8. They shall be equipped with ambient temperature compensating features extending to 40°C.

M. Select compact molded case breakers in accordance with the following:-

1. They shall consist of manually operated quick-make, quick-break mechanically trip free operating mechanisms for simultaneous operating of all poles, with contacts, and trip elements for each pole, all enclosed in molded phenolic plastic cases. Trip units for these breakers shall be of the "thermalmagnetic" type having bimetallic elements for time delay overload protection and magnetic elements for short circuit protection.

2. They shall have an interrupting rating of at least 10,000 amperes RMS asymmetrical.

3. They shall be of a type capable of being used with main devices incorporated in the panelette, or upstream devices, to establish the required series rated short circuit capability indicated elsewhere.

4. They may be of the plug in type but shall be arranged for tamper resistant mounting to prevent the interchange of breakers having trip sizes outside of prescribed ranges.

5. They shall be equipped with ambient temperature compensating features extending to 40°C.

6. They shall be equipped with 5 milliamp ground fault interrupting features where so indicated.

N. The fuses to be used in current limiting circuit breakers shall, regardless of actual available fault current, at full recovery voltage, be capable of safely interrupting fault currents in the order of 200,000 amperes RMS symmetrical of 280,000 amperes RMS asymmetrical. The current limiting fuses shall coordinate with and back up the circuit breakers they are associated with so that all fault overload currents occurring within the safe capability of the breakers shall cause the breakers to open, and all currents occurring beyond the safe capability of the breakers shall cause the fuses to open; the opening of fuses being such as to prevent damage to any circuit breaker component parts. Where directed, fuses shall be reduced in size so as to provide backup protection for downstream overcurrent devices.

O. All applications of fuses shall be on a "single fuse per phase leg" (i.e., exclude fuses in multiple).

P. Fuses shall be mounted so that the labels showing their ratings can be read without requiring fuse removal.

Q. Where the sizes of overcurrent protection and switching devices are indicated by means of single number amperages, it shall be understood that these amperages represent as applicable the size of the trips or fuses supplied in the smallest circuit breaker frames or switches that will hold them.

R. Furnish and deposit spare fuses at the job site as follows:-

1. Three spares for each type and size, in excess of 60 amperes, used for initial fusing.

2. Ten percent spares for each type and size, up to and including 60 amperes, used for initial fusing. (In no case shall less than three fuses of one particular type and size be furnished).

S. Where fuses are required to be installed in fuse gaps which are too large or are otherwise not matched to the fuses, utilize single step reducers or adaptors to accommodate the mounting. In addition, provide clip clamps to anchor the reducers or adaptors into the fuse gaps.

T. Select features constituting exception or amendment to the above for specifically located devices as follows:-

1. Molded case circuit breakers mounted at the following locations shall be equipped with ambient temperature compensating features extending to 50°C.

a. In penthouse mechanical room.

U. Distribution switches of the bolted pressure type shall be manufactured by Pringle, Westinghouse, General Electric, or Square D or other approved.

V. Distribution switches of the quick-make, quick-break type shall be manufactured by Siemens, General Electric, Westinghouse, or Square D or other approved.

W. Circuit breakers shall be manufactured by Westinghouse, General Electric, Siemens, or Square D or other approved.

X. Fuses shall be manufactured by Bussman, or Gould-Shawmutt or other approved.

2.5 DRY TYPE TRANSFORMERS -- SECONDARY VOLTAGE TO SECONDARY VOLTAGE

A. All transformers shall be suitable for carrying continuously non-linear (i.e., non-sinusoidal) loads equal to 100% of their nameplate rating without exceeding an average temperature rise of 115°C. This suitability shall be based on loads having a "K-Factor" of 13, and shall apply regardless of the harmonic current distribution making up the "K-13" loading. These transformers shall each comply with the following:

1. It shall bear a UL label stating its suitability for K-13 loads.

2. Its primary winding conductors shall be sized so as to limit temperatures to the values stipulated above taking into account the circulating currents produced by the 3rd, 9th and 15th harmonics.

3. Its secondary winding neutral conductors and terminal shall be sized to have twice the ampacity of the phase conductors.

4. Windings and other current carrying elements shall utilize copper or aluminum conductors.

5. Core and winding design shall be such as to minimize eddy current losses and to reduce the core flux density well below the saturation point to prevent core overheating caused by harmonic distortion.

6. It shall be provided with an electrostatic shield between windings.

7. Its insulation shall comply with NEMA ST20 standards for a 220°C UL component recognized systems.

8. It shall comply in all other respects with the requirements specified hereinafter for transformers which are not K-Rated.

B. Select individually mounted dry type 3 phase transformers for light and power in accordance with the following:-

1. They shall be of the indoor ventilated type.

2. They shall be 3 phase step down.

3. They shall be for 60 cycles operation.

4. They shall each have a delta connected high side rated for 480 volts and a wye connected low side rated for 120/208 volts.

5. They shall have full capacity taps in their high side windings as follows:-

   - (2) 2-1/2% above normal

   - (4) 2-1/2% below normal

6. Up to and including 15 KVA, they shall be suitable for wall mounting. Larger than 15 KVA, they shall be suitable for platform mounting.

7. They shall have sheet metal casings which are coated inside and out with a rust inhibiting primer and finished with a factory coat of enamel.

8. They shall be designed so that the full load temperature rise does not exceed 115°C over a 40° ambient, however, the insulation shall conform to NEMA ST20 Standards for a 220°C UL component recognized insulation system.

9. Submit manufacturers certification that the sound outputs of transformers do not exceed the following levels based on NEMA standard testing procedures:-

TRANSFORMER RATING	SOUND OUTPUT
9	40
15	42
30	42
45	42
75	45
112-1/2	45
150	45
225	49
300	49
500	53

C. Windings and other current carrying elements shall utilize copper or aluminum conductors.

D. Submit manufacturer's certification that 75°C operating temperature wires connecting to their terminals will not be damaged under full load conditions if the ambient temperature is maintained at 30°C.

E. Submit manufacturers certification that peak excitation currents do not exceed twelve times full load current for transformers 30 KVA and larger or thirty-two times full load current for transformers less than 30 KVA.

F. Dry type transformers shall be manufactured by Square D, International Transformer Corp. or Jefferson, Magnetek or other approved.

2.6 BUS DUCT

A. Bus ducts are existing.

2.7 UNDER FLOOR DUCT

A. The system is existing and shall be used as required.

PART 3 - EXECUTION

3.1 SECONDARY ELECTRIC SERVICE

A. The permanent electrical supply for the project is existing. Current characteristics is 460/265 volts, 3 phase, 4 wire, 60 herz A.C.

B. Provide new work as shown.

3.2 INSTALLATION OF PANELBOARDS

A. Install plumb and flush with wall finishes, where flush mounted, in conformance with NEMA PB-1.

B. Provide filler plates for unused spaces in panels.

C. Provide typed directories for circuits in each panel.

3.3 INSTALLATION OF DRY TYPE TRANSFORMERS

A. Install transformers in accordance with the following:

1. Wall mount transformers 15 KVA and less. Suspend transformers larger than 15 KVA and in sizes up to and including 75 KVA from the structure overhead. Utilize trapeze type hanger arrangements for the purpose. Floor mount all transformers larger than 75 KVA.

1A. Coordinate location of ceiling suspended transformers with building structure and with equipment in closet so as to insure accessibility and working clearances. If necessary, to so insure, floor mount transformers in lieu of suspending them. Modify closet layout accordingly.

2. Floor or wall supported transformers shall be resiliently isolated from the building structure by means of neoprene in shear isolator providing a minimum static deflection of 3/8 inch.

3. Ceiling supported transformers shall be resiliently suspended by means of neoprene in shear hanger rod isolators providing a minimum static deflection of 3/8 inch.

4. Make any required changes to transformer tap connections in accordance with instructions issued by the Architect in the field.

3.4 INSTALLATION OF FEEDERS

A. Feeder connections shall be in the phase rotation which establishes proper operation for all equipment supplied.

B. Indications of conductor sizing for three phase and three phase/four wire feeders shall, unless otherwise noted on the drawings, be understood as follows:

1. (3) equally sized conductors represents a three phase feeder.

2. (4) equally sized conductors represents a three phase/4 wire feeder with 100% neutral.

3. (3) equally sized conductors plus (1) larger conductor or (2) equally sized conductors represents a three phase/4 wire feeder with neutral oversided to accommodate "harmonic-rich loads."

4. (3) equally sized conductors plus (1) smaller conductor represents a three phase/three wire feeder plus ground wire.

5. (3) equally sized conductors plus (1) larger conductor or (2) equally sized conductors and one smaller conductor represents a three phase/four wire feeder with neutral oversized to accommodate "harmonic-rich" loads plus a ground wire.

C. Feeders consisting of multiple cables and raceways shall be arranged such that each raceway of the feeder contains one cable for each phase leg (and one neutral cable if any).

D. Each individual tap off a feeder which consists of multiple cables per phase (and neutral if any) shall be arranged so that all of the cables of a phase leg (and neutral if any) of the feeder are connected to the corresponding phase leg (and neutral if any) of the individual tap.

3.5 INSTALLATION OF LIGHTING AND APPLIANCE BRANCH CIRCUITRY

A. All lighting fixture, toggle switch, and receptacle outlets indicated or called for with no detailed layout of their circuitry shall be wired up with lighting and appliance branch circuitry protected at 20 amps or less, as hereinafter specified.

B. Circuitry indicated without sizing shall be understood to be lighting and appliance branch circuitry protected at 20 amps or less.

C. Conform all lighting and appliance branch circuitry (regardless of whether protected above or below 20 amps) to the following:-

1. Except as noted below, circuitry shall be multi-wire utilizing common neutrals arranged so that no neutral conductor acts as a common wire for more than one circuit conductor connected to the same phase leg of the supply system.

1A. Common neutrals shall not be utilized for circuitry runs containing more than (6) 120 volt receptacle circuits within a single raceway (conduit, cellular deck, underfloor duct) except as specified hereinafter for home runs in main header runs of underfloor electrification systems.

1AA. Conductors used as common neutrals for multiple (2 or 3) 120 volt branch circuits protected at 20 amps or less shall be #10 AWG where such circuits supply receptacles which are dedicated to - or may be utilized for - "harmonic-rich" loads such as personal computers, computer terminals, word processors, printers and the like. Accordingly, common neutrals supplying receptacles shall be understood to be #10 AWG under the following conditions:

a. Wherever so indicated (by note or otherwise) on the drawings.

b. Throughout all office areas, computer rooms or other data processing spaces, laboratories, trading floors

c. Throughout all normally occupied spaces.

2. Branch circuitry supplying relay controlled lighting fixtures shall be understood to include all necessary interconnections between the control panels containing the relays and the associated lighting or appliance panels.

2A. Regardless of any indication to the contrary on the floor plans, circuits emanating from panel branches having ground fault interrupting features shall be two wire with no common neutrals.

3. Circuitry for dimmed lighting equipment shall be two wire with no common neutrals.

4. Under no condition shall any local switch break a neutral conductor.

5. At any location where lighting and appliance branch circuitry is extended from a flush mounted panelboard to a suspended ceiling immediately above, at least four 1-inch empty conduits shall be included (in addition to those required for active circuitry) to permit future wiring escape from the panelboard. The empty conduits shall extend up from the panel and shall terminate in a threaded conduit cap immediately after turning out into the hung ceiling space.

6. Raceway sizes shall conform to standard maximum permissible occupancy requirements except where these are exceeded by other requirements specified elsewhere.

7. Unless in accordance with requirements specified below for circuitry run through a series of lighting fixtures, exclude wires of the type specified for light and power distribution and circuitry from the interior of lighting fixtures.

8. Where circuitry is to be run through a series of lighting fixtures, conform to the following:-

   a. Utilize a wire type whose allowable operating temperature is not less than 90°C.

   b. Submit certification that the wires used are of a type that will not be damaged by the temperatures to which they will be subjected within the fixtures.

   c. Utilize wires with conductors equal to those in the wires supplying outlet to which the fixtures are connected.

   d. Exclude connections to the circuitry of any energy consuming items (or outlets for same) other than the series of fixtures through which it is run.

9. Two and three pole branches in panels shall be used respectively for individual single phase load items connected line to line and individual three phase load items. Where circuitry indications require the use of 2-pole and/or 3-pole branch breakers which have not been scheduled, provide in the panelboards the required multi-pole breakers in lieu of the equivalent number of single pole branch breakers. Required quantities of single, two and three pole branch breakers shall be confirmed prior to ordering panels.

D. Conform lighting and appliance branch circuitry, indicated as being protected at 20 amps or less, to the following:-

1. Operating in the range of 100 to 125 volts to neutral, circuitry shall be supplied from 15 amp panel branches except as indicated.

2. Operating in the range of 100 to 125 volts to neutral, circuitry shall be supplied from 20 amp panel branches except as indicated, and as noted below:

   a. Circuitry supplying multi-outlet receptacle circuits shall be connected to 15 amp panel branches unless otherwise noted or specified hereinafter.

   b. Circuitry supplying solidly-connected equipment whose load does not exceed 1260 ascribed watts (i.e., volt amps) shall be connected to 15 amp panel branches.

3. Operating in the range of 250 to 300 volts to neutral, circuitry shall be supplied from 20 amp panel branches.

4. Where the indicated circuitry involves the connection of more than (10) individually mounted lighting fixtures to a single circuit operating in the range of 100 to 125 volts to neutral, or more than (20) such fixtures to a 250/300 volts to neutral circuit, it shall be understood that the quantity of outlet boxes on any such circuit is to be limited to the (10) or (20) described above, and that multiple lighting fixtures shall be connected to each such outlet box, in an approved manner, as necessary to conform to this requirements.

5. Except as specified below, minimum conductor size shall be #12 AWG copper.

5A. Common neutrals shall not be utilized for circuitry runs containing more than (6) 120 volt receptacle circuits within a single raceway (conduit, cellular deck underfloor duct) except as noted below..

6. Conductors for circuitry operating in the range of 100 to 125 volts to neutral and extending in excess of 75 feet, from the point of supply, to the first outlet shall be #10 AWG (minimum) copper to the first outlet. Increase beyond #10 AWG if required for compliance with code-mandated voltage drop restrictions.

7. Conductors for circuitry operating in the range of 250 to 300 volts to neutral and extending in excess of 150 feet, from the point of supply, to the first outlet shall be #10 AWG (minimum) copper to the first outlet. Increase beyond #10 AWG if required for compliance with code-mandated voltage drop restrictions.

8. Conductors used in runs consisting of more than six wires (exclusive of grounding conductors) in a single raceway shall be #10 AWG copper minimum. Increase beyond #10 AWG as required to comply with code-mandated derating factors, and as specified hereinbefore.

9. Circuits supplying receptacles which are not of the ground fault circuit interrupting type, and are located as noted below, shall be connected to panel branches that are equipped with ground fault interrupting features:

   a. Receptacles located in bathrooms. Bathrooms shall be defined as spaces containing a basin, toilet, tub or shower.

   b. All receptacles mounted on building exterior surfaces.

10. Circuits supplying pipe tracing cable and HWAT cable shall be connected to panel branches equipped with 30 ma ground fault interrupting features for equipment protection.

E. Where outlets or lighting fixtures are required to be wired up with (20 amps or less) lighting and appliance branch circuitry which has not been delineated, conform to the following:-

1. When circuiting up recessed ceiling lighting fixtures, connect fixtures on the basis of more than one fixture to a single outlet box, in an approved manner, as required to insure that circuits will not be unnecessarily lightly loaded due to mandated, restrictions on the maximum number of outlets per circuit. Except with special permission, unnecessarily light loading shall be understood to mean, less than 1000 watts on a 100 to 125 volt to neutral circuit, and less than 3200 watts on a 250 to 300 volt to neutral circuit.

2. The total wattage on a circuit shall be computed by ascribing wattage to individual items on the basis of the following:-

(Note: The ascribed wattage listed, and the totals permitted on the circuits, both account for power factor where applicable, i.e, the figures represent volt-amperes)

ITEM	ASCRIBED WATTAGE
Any lighting fixture.	Input volt-amps as per lighting fixture schedule.
Any outlet with no specific wattage or circuiting instruction indicated.	180 volts
Any outlet (other than for resistance heating) with wattage indicated.	1.15 x Indicated wattage
Any resistance heating outlet with wattage indicated.	1. x Indicated wattage
Any fractional HP motor with HP indicated.	2500 x Indicated HP
Any outlet with amps indicated.	115 x Indicated amps

3. Not more than (10) outlets or 1260 total watts shall be applied to any single 15 amp panel branch circuit operating in the range of 100 to 125 volts line to neutral.

3A. Not more than (2) outlets or 1650 total watts shall be applied to any single 20 amp panel branch circuit operating in the range of 100 to 125 volts line to neutral.

3B. Not more than (20) outlets or 4000 total watts shall be applied to any single 20 amp panel branch circuit operating in the range of 250 to 300 volts line to neutral.

4. Lighting fixtures operating in the range of 100 to 125 volts line to neutral shall be connected to 20 amp panel branch circuits. Not more than 1650 total watts shall be applied to any such circuit. Receptacles and solidly connected equipment operating at 120 volts line to neutral and totaling not more than 1260 watts shall be connected to 15 amp panel branch circuits except as indicated or noted hereinafter.

5. A separate circuit, supplying no more than two similarly indicated outlets, emanating from a 20 amp panel branch and operating in the range of 100 to 125 volts to neutral shall be used for each outlet indicated as an "Appliance Circuit" outlet.

6. Circuitry for outlets and fixtures on normal supply shall be wired to the nearest tenant use normal service lighting or appliance panel having the proper line to neutral voltage in an electric closet on the same floor.

7. Any installed lighting and appliance branch circuitry, found (as a result of unnecessarily light loading of conductors) to make excessive use of panel branches, shall be rearranged.

8. Any installed lighting and appliance branch circuitry, found (as a result of unnecessarily light loading of conductors) to require more than the indicated allowance of active circuits, assigned for it in any panelboard, shall be rearranged.

9. Lighting fixtures and receptacles shall not be connected to the same branch circuit.

10. Circuitry operating in the range of 250 to 300 volts to neutral shall be maintained in the raceways or armored/metal clad cables separate from circuitry operating in the range of 100 to 125 volts to neutral.

11. Only lighting fixtures containing electric discharge type lamps and solidly connected electric heating equipment may be supplied from circuits operating in the range of 250 to 300 volts line to neutral. Lighting fixtures shall not be permitted to have integral switches, nor shall they be of the screw shell lamp holder type where mounted below eight feet.

12. Circuitry for night light, emergency and exit sign lighting fixtures shall be maintained separate from all other circuitry.

13. Circuitry for night light, emergency and exit sign lighting fixtures shall be wired to the nearest emergency service lighting or appliance panel having the proper line to neutral voltage in an electric closet on the same floor.

14. Circuits shall be balanced on phases at their supply point as evenly as possible.

15. The final arrangement of lighting and appliance branch circuitry shall be fully delineated on the record, or "as-built" drawings called for elsewhere.

3.6 GROUNDING REQUIREMENTS

A. Ground all systems and equipment in accordance with best industry practice and the following.

B. The grounding stud of each secondary voltage to secondary voltage dry type 3 phase transformer for light and power shall be connected separately to the grounding electrode for such transformers specified below. Connection shall be by means of a green insulated copper conductor, run in threaded steel conduit, sized in accordance with the following:-

Transformer KVA	Grounding Conductor & Conduit Size		
0 - 45	1#6	-	½"C
46 - 75	1#2	-	3/4"C
76 - 150	1-3/0	-	1"C
151 and larger	1-250M	-	1-1/4"C

C. The neutral of each the secondary voltage to secondary voltage dry type 3 phase transformer shall be connected to the transformer grounding stud by means of a bonding jumper equal in size to the grounding electrode conductor describing above. Unless factory installed, the bonding jumper shall be field installed within the transformer enclosure.

D. The grounding electrode for each secondary voltage to secondary voltage dry type transformer shall consist of an exothermic welded connection to adjacent structural steel. Chop concrete encasement as required to expose steel.

E. Include a properly sized green insulated grounding conductor within the conduit for each feeder supplying a panel containing an isolated ground bus (i.e., insulated from ground). Increase indicated conduit size if necessary to accommodate this conductor. Connect to the system neutral grounding facility at 480-120/208 volt stepdown transformers or at the service entrance point as applicable.

F. Provide supplementary ground bonding for each motor control center (MCC) as follows:

- Provide equipment grounding conductors as required to insure that all sections (including attached integral or field installed pullboxes) are bonded together by means of these conductors and by means of the MCC ground bus (if a ground bus is included in the MCC).

- Provide grounding bushings and jumpers as required to insure that all conduits and any contained equipment grounding conductors are bonded to the enclosure grounding conductors (or ground bus).

G. Each grounding type bushing shall have the maximum ground wire accommodation available in standard manufacture for the particular conduit size. Connection to bushing shall be with wire of this maximum size.

H. Provide supplementary ground bonding to maintain continuity of the equipment and raceway grounding system as follows:

1. Bonding jumpers applied where wiring devices (receptacles and switches) are not equipped with approved self-grounding features. Include any necessary field modifications for termination of the bonding jumpers so as to insure grounding continuity.

2. Bonding jumpers applied to insure that grounding continuity does not depend solely on the supporting screws fastening metallic enclosures together.

3. Include any necessary field modifications for termination of the bonding jumpers so as to insure grounding continuity.

I. The neutral lead of each the emergency generator shall be grounded. Grounding methods and materials shall be as specified for the normal service.

J. Provide grounding of raised metallic floors used to contain wiring to computers and/or other equipment. Where the floor system is of a type that is specifically designed by the manufacturer to maintain ground continuity through its metallic structural support system, the grounding may be accomplished by means of no fewer than (8) bonding connections spaced equally about the perimeter but in no case more than 100 feet part. Utilize #8 AWG green insulated copper conductors for the connection of the bonding locations to structural steel. If the raised floor is to be used as an air handling plenum, the insulation shall be of a fluoropolymer type suitable for use in plenums without raceway. If the floor system is not designed to maintain ground continuity through the metallic structural support system, alternating support pedestals in each direction must be connected to the bonding conductors.

K. Provide a ground connection for each 100 feet of run of cable tray, and for each isolated run of less than 100 feet, by means of a #6 AWG green coded insulated copper conductor run in ½".

L. The grounding electrode for each run of cable tray requiring same shall consist of a cadweld connection to adjacent structural steel. Chop concrete encasement as required.

M. Provide a #6 AWG in ½" conduit green insulated copper ground wire connection to cold water pipe or other main building service grounding electrode for each the telephone frame room and or main telephone equipment room.

N. Provide supplementary bonding and grounding for each the pool (swimming, ornamental, therapeutic or other), fountain spa or hot tub, in accordance with the requirements of Article 680 of the latest edition of NFPA 70 (The National Electrical Code).

O. The central equipment for each fire protective sub alarm system and for cable TV system and or any communication, data or alarm system whose source originates outside the building shall have its grounding terminal connected to the nearest metallic cold water main or riser ground bus cable by means of a #6 green coded insulated conductor, run in 3/4" threaded metallic conduit. Utilize a ground clamp of a type specifically manufactured for the purpose.

P. Exclude aluminum conductors from any grounding electrode connection which goes into the ground or becomes concrete embedded at the point of attachment to the electrode.

Q. Where ground wires, intended for "clean grounds," are connected at receptacle outlets in which there is integral bonding between the grounding pole and the outlet box such bonding shall be opened up.

R. Where specifically indicated and each feeder or run of lighting and appliance branch circuitry used as a final branch circuit for computers include equipment and raceway grounding conductors run within the raceways. For runs utilizing armored cable, the grounding conductor shall be contained with the cable. The indicated quantities of conductors for runs of branch circuitry which require ground wires do not include the ground wires. When sizing raceways for such runs, adjust sizes accordingly.

S. Conductors utilized for grounding and bonding shall have type "TW" or better insulation, color coded green.

T. Bonding conductors on the load side of the service device and equipment grounding conductors shall be sized in relation to the fuse or trip size of the overcurrent device supplying the circuit in accordance with the following table:-

SIZING OF EQUIPMENT AND RACEWAY GROUNDING CONDUCTORS AND LOAD SIDE OF SERVICE BONDING JUMPERS

OVERCURRENT DEVICE JUMPER FUSE OR TRIP SIZE (AMPS)	GROUNDING CONDUCTOR OR BONDING SIZE--CU **	(AL)
15,20	#12	-
25-60	#10	-
70-100	#8	-
110-200	#4	(#4)
225-400	#2	(1/0)
500,600	* 2 x #1	(2 x 2/0)
700,800	* 2 x 1/0	(2 x 3/0)
1000	* 3 x 2/0	(3 x 4/0)
1200	* 4 x 3/0	(4 x 250) MCM
1600	* 5 x 4/0	(5 x 350) MCM
2000	* 6 x 250 MCM	(6 x 400) MCM
2500	* 7 x 350 MCM	(7 x 600) MCM
3000	* 8 x 400 MCM	(8 x 600) MCM
4000	* 11 x 500 MCM	(11 x750) MCM

* Adjust quantity (if needed) to match number of conduits in run.

** Where phase leg conductor ampacity exceeds overcurrent device, increase grounding conductor as if the overcurrent device size matched the phase leg ampacity.

U. Grounding electrode conductors and conductors used for bonding on the supply side of the service device shall be sized in accordance with the following table:-

V. Connections of ground wires shall be in accordance with the following:-

LOCATION	GROUND WIRE CONNECTION
Secondary voltage to secondary voltage transformer	Transformer ground stud

3.7 ELECTRIC MOTOR DRIVEN EQUIPMENT IN MECHANICAL SYSTEMS

A. Refer to the "Specification Notes Pertaining to the List of Electric Motors and Motor Controls" for electrical and HVAC requirements in conjunction with HVAC electric motor driven equipment.

AA. Where variable frequency drives are furnished as part of the HVAC work, the installation of this equipment as part of the electric work shall include:

1. The installation of all furnished components whether they are incorporated into a single enclosure or into several enclosures regardless of any indication on the drawings as to the number of enclosures.

2. All required interwiring between components.

3. Control interwiring (and any auxiliary components) required to insure that instructions on the drawings regarding automatic control by/and status reporting to the Fire Alarm System and/or the BMS occurs regardless of whether the motor is controlled by the variable frequency drive or by the across-the-line magnetic starter provided for "bypass" purposes.

B. In conjunction with the electric motor driven equipment which occurs in plumbing systems, excluded from the electric work will be:-

1. The furnishing of all motors, motor starters and motor control actuating and actuated devices.

2. The installation of all motors.

3. The installing of motor control devices, such as pressurestats, aquastats, and solenoid valves, which require connections to plumbing systems.

4. The installing of motor control devices, such as float switches, limit switches etc. whose placement in relation to plumbing equipment is critical.

C. For electric motor driven equipment in plumbing systems, include in the electrical work:

1. The furnishing and installing of motor power circuitry up to motor terminals with connection to same including the providing of all "crown boxes" or other type of termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt them to the building wiring as called for and to the connection methods set forth in these specifications.

2. The furnishing and installing of Plumbing motor control circuitry, and the installation of motor control devices where specifically indicated elsewhere.

3. The furnishing and installing of code mandated line disconnect means (other than those integral with motor starters).

4. The installing of motor starters.

5. The installing of motor control actuating and actuated devices which do not require connection to plumbing systems or critical positioning in relation to plumbing equipment.

6. The adapting and making up of uncoordinated internal wiring of motor starters to accommodate required control schemes including:

   a. The connection of cover-mounted pushbuttons, pilot lights and selector switches.

   b. The interconnecting of various control and protective relays supplied in the starters interposed between their holding coils and their operating control circuits.

   c. The interconnecting of control transformers for 120 volt functioning of operating control circuits where motor operates at above 250 volts line to line.

7. The removal of toggle switch type starters, indicated as being flush mounted, from the surface enclosures supplied with them, and the resetting of such starters into flush wall outlet boxes with device plates matching the surrounding hardware.

8. The installing of certain multiple motor starter cabinets, as indicated.

9. The line fusing of all fusible combination starters.

10. The proper setting of adjustable motor control circuit relays.

11. The substitution of local multiple disconnect means with suitable overcurrent protection for the indicated single unfused device when necessary to meet the actual power supply requirements of package motorized equipment which is shown supplied by a single feed but which is not adapted to same.

D. For electric motor driven equipment in plumbing systems, include in the electrical work, for motor starters not furnished as part of the electric work the issuing of instructions to the trades purchasing motor starters, as required, to assure that:-

1. All starters are of the type and size required, and include correct devices in their covers.

2. Starters are each equipped with overcurrent relays rated not in excess of the nameplate current of the associated motor as follows:-

   a. One for single pole starters.

   b. One for each pole of multiple starters.

3. All magnetic starters intended to operate on a power circuit voltage in excess of 250 volts line to line are supplied with fused transformers to permit control circuit operation at 120 volts.

4. All magnetic starters size 2 and larger intended to operate on a power circuit voltage less than 250 volts line to line are supplied with control circuit fuses.

5. All magnetic starters size 2 and larger are supplied with auxiliary control circuit relays to exclude holding coil currents from the external control circuit wiring.

6. All magnetic starters N.E.M.A. size 5 and larger are supplied with phase failure protection relay systems.

7. All package units requiring external motor control circuitry are supplied with accessible terminals for such circuitry so that the need to break into the factory wiring of the units is eliminated.

8. All magnetic starters are supplied with the required type and number of auxiliary contacts.

E. Notify the Architect of any failure to comply with the above instruction prior to performing any installation work.

3.8 PROCESS CONTROL SYSTEMS

A. Process control systems will be furnished and installed separate from the electrical work. The electrical work shall, however, include the following items required for the support of these systems:-

1. Motor control circuitry ties to the system, such as connections from motor starters to EP and PE devices.

2. Where the process control system incorporates central monitoring and control, and/or where the wiring of local control devices is part of the process control work, include terminal strip cabinets and 6 wire motor control circuitry runs to serve as the interface between the electrical work and the process control work. Cabinets to be located within 30 feet circuiting distance of each motor control center, individually mounted starter and packaged unit equipment, which is tied to the process control system, or at other locations in mechanical rooms as indicated or directed. Incorporate (6) dual isolated terminals for each associated motor, and 25% spare terminals.

3. 120 volt branch circuitry extensions for the supply of damper control devices (E.P. switches, process control relays for electric damper motors) for dampers requiring "smoke purge" or "after hours" control via the Fire Alarm System. Provide one such extension from an "emergency" source for each exhaust or return damper used for "smoke purge". Provide one such extension from a "normal" source for each supply damper requiring after hours control. Connect as required. See smoke exhaust damper system wiring diagram.

3.9 MOTOR CONTROL CIRCUITRY

A. Except as noted below, select materials exactly as specified for feeders. Utilize #14 A.W.G. THWN conductors throughout; except in conjunction with a manual starter utilize conductors equal in size to those in the power circuit.

B. Motor control circuit wires may be run in the same conduit as the wires of motor power circuits; however, abide by the following:-

1. Exclude motor control wires from enclosures (other than motor starter enclosures) which contain power circuit overcurrent protection and switching devices; also from pull boxes and junction boxes containing the wires of main and submain feeders. Utilize auxiliary pull boxes to separate motor control wires from motor power circuit wires before the power circuit wires enter the items from which motor control wires are excluded.

2. Exclude motor control wires from the same conduits as motor power circuit wires larger than 250 MCM.

C. To fulfill the control circuitry requirements for individual motors and for mechanical equipment alarms wherever feasible, utilize the conductors indicated in bulk quantities in the main motor control wiring system.

D. Prior to installing any motor control circuitry for a particular motor, notify the Architect of any deviations between the control circuitry requirements of the trade supplying the motor and the indicated electric work.

END OF SECTION

SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Lighting Fixtures and controls as described.

1.2 RELATED WORK

A. Section 16050 - Basic Electrical Materials, Methods and Requirements.

1.3 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data describing fixtures, lamps, and ballasts. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

1. Outline drawings indicating dimensions and principal features of fixtures.

2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.

C. Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, method of field assembly, components, features, and accessories.

D. Wiring diagrams as requested for selected fixtures showing both factory-installed and field-installed wiring for specific system of this Project, and differentiating between factory-installed and field-installed wiring.

E. Air and thermal performance data for air-handling fixtures. Sound performance data for air-handling fixtures. Provide certified test reports indicating sound power level and Sound Transmission Class (STC).

F. Product certificates signed by manufacturers of lighting fixtures certifying that their products comply with specified requirements.

G. If shop drawings are submitted for a specific fixture by a manufacturer other than specified, and approvals cannot be acquired by the third submission, then the equipment will not be accepted and the specified equipment will be furnished.

H. Samples shall be furnished as directed.

1.4 QUALITY ASSURANCE

A. Comply with New York City Electrical Code and P.P. Standards.

B. Electrical Component Standard: Provide components that comply with NYC Electrical Code and that are listed and labeled by UL where available.

C. Listing and Labeling: Provide fixtures and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.

1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.

2. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

D. Fixtures for Hazardous Locations: Conform to UL 844.

E. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space. They shall include clips or other mechanical mounting lugs as required for support of the fixtures in a code approved manner.

F. Lighting fixtures, ballasts, lamps and other components shall equal or exceed the requirements of all applicable state and/or municipal "energy codes."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, fixtures that may be incorporated into the Work include, but are not limited to, the products specified in Lighting Fixture Schedule. Where three manufacturers are indicated for each fixture type, no other manufacturers will be considered. Where one manufacturer is indicated for each fixture type, other manufacturers will be considered if equality to the specified equipment can be determined by the engineer, architect or lighting consultant.

B. They shall be complete with all appurtenances necessary for their proper operation, installation, and support.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Lighting fixture components shall be suitable for the voltage of the building circuits to which they are applied.

B. Lighting fixtures shall be constructed with joints made only by means of welded, brazed, screwed, or bolted construction methods. Soldered joints will not be permitted. No self-tapping screws, bled metal tapping methods, or rivets, shall be employed for fastening any parts to or in any wireway or wiring chamber, for fastening any parts which must be removed to gain access to electrical components requiring service or replacing, or for fastening any electrical component or support for same.

C. Any ferrous parts and supports, other than parts manufactured of stainless steel, shall be completely rustproofed after fabrication, and before finish coatings are applied. Rustproofing shall be by means of galvanizing, bonderizing, zinc plating or by treatment with other industry standard rust preventing processes providing rustproofing qualities equal to the processes mentioned.

D. All screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated.

E. All metallic cast or extruded parts shall be close grained, sound, and free from imperfections or discolorations. Cast or extruded parts shall be rigid, true to pattern, and of ample weight and thickness. Cast or extruded parts shall be properly fitted, filed, ground buffed, and chased to provide finished surfaces and joints free of imperfection with all details or ornamentation brought out. Finished thickness of all cast parts shall not be less than 1/8 inch.

F. Housings shall be so constructed that all electrical components are easily accessible and replaceable without removing them from their mountings.

G. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

H. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

I. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

J. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2. Lens Thickness: 0.125 inch (3 mm) minimum; except where greater thickness is indicated.

K. Fixture Support Components: Comply with Section 16050 "Basic Electrical Materials and Methods." In particular, note the requirements relating to seismic design.

1. Single-Stem Hangers: ½-inch (12-mm) (minimum) steel tubing with swivel ball fitting and ceiling canopy arranged so that stems hang vertically regardless of the angle of the surface they are mounted from. Finish same as fixture unless otherwise noted.

2. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.

3. Hook Hanger (only for fixtures so specified): Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

4. Provide pendant mounting for fixtures types indicated as suitable for surface or pendant mounting in accordance with instructions issued in the field.

5. Only rigid metallic pipe stems shall be utilized for the support of pendant mounted lighting fixtures unless otherwise indicated in the lighting fixture schedule.

6. Exclude "twin-stem" hangers for fluorescent lighting fixtures.

7. Wherever a fixture or its hanger canopy is applied to a surface mounted outlet box, a finishing ring shall be utilized to conceal the outlet box.

L. All lamp sockets in lighting fixtures shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components.

M. Fixtures for use outdoors or in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture.

N. Fluorescent Fixtures: Conform to UL 1570.

O. Provide high efficiency fluorescent ballasts as indicated in the lighting fixture schedule. If specific ballasts are not identified in the schedule, provide as follows:

1. For T8, T12 and T5 lamps (over 36 lamp watts), ballasts shall be solid state.

2. For compact fluorescent lamps under 35 watts, ballasts shall be magnetic unless otherwise noted in fixture schedule. Coordinate 2 pin/4 pin lamps technology with proposed ballasts.

P. Solid State Fluorescent Ballasts: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.

1. Certification by Electrical Testing Laboratory (ETL).

2. Labeling by Certified Ballast Manufacturers Association (CBM).

3. Type: Class P, high power factor, except as otherwise indicated.

4. Sound Rating: "A" rating, except as otherwise indicated.

5. Voltage: Match connected circuits.

6. Lamp Flicker: Less than 5 percent.

7. Minimum Power Factor: 90 percent.

8. Total Harmonic Distortion (THD) of Ballast Current: Less than 20 percent.

9. Conform to FCC Regulations Part 18, Subpart J for electromagnetic interference.

10. Conform to IEEE C62.41, Category AZ, for resistance to voltage surges for normal and common modes.

11. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp fixtures where possible.

12. All solid state ballasts for T8, T12 and T5 (over 36 lamp watts) shall be instant start unless otherwise noted and manufactured by Magnetek, Motorola, ESI, Ostam/Sylvania.

13. All solid state ballasts for compact fluorescent lamps under 35 watts shall be manufactured by Lightolier, Magnetek, Roberts, ESI.

14. Lamp-ballast connection method does not reduce normal rated life of lamps.

15. Ballast Factor shall be a minimum of .87 unless otherwise specified in the lighting fixture schedule.

16. Ballasts shall operate the lamps in parallel.

17. Ballasts shall be encapsulated to ensure maximum thermal and structural integrity.

18. Ballasts shall be warrantied for a minimum of five years including labor.

Q. Electromagnetic compact fluorescent lamp ballasts:

1. Certification by Electrical Testing Laboratory (ETL).

2. Labeling by Certified Ballast Manufacturers Association (CBM).

3. Type: Class P, high power factor, except as otherwise indicated.

4. Sound Rating: "A" rating, except as otherwise indicated.

5. Voltage: Match connected circuits.

6. Minimum Power Factor: 90 percent.

7. Electromagnetic ballasts shall be rapid start and manufactured by Magnetek, Advance, Roberts.

8. Low-Temperature Fluorescent Ballasts: Comply with above requirements, except ballast may be Class P electromagnetic type. Starting temperature is minus 20 deg C or colder.

9. Ballast Factor shall be a minimum of .90 unless otherwise specified in the lighting fixture schedule.

R. Fluorescent Dimming Ballasts: Electronic type providing smooth dimming over a minimum range from 100% to 1% unless otherwise noted in lighting fixture schedule. Listed for use with specific fluorescent dimming system provided. Dimming ballasts shall be manufactured by Lutron, Lightolier, ESI or Motorola.

S. Air-Handling Fixtures: Arranged for use with plenum ceiling for air return and heat extraction and for attachment of an air-diffuser boot assembly specified in Division 15.

1. Sound Transmission Class (STC): Conform to ADC Standard AD 63.

2. Supply Units: Equip with slots in one or both side trims and join with air-diffuser boot assemblies.

3. Heat Removal Units: Provide an air path through lamp cavity.

4. Static Fixtures: Slots blanked, with fixture appearance matching active units.

T. High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.

U. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include the following features, except as otherwise indicated.

1. Constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise indicated.

2. Operating Voltage: Match system voltage.

3. Single-Lamp Ballasts: Minimum starting temperature of -40 deg F. for HPS and -20 deg. F. for metal halide.

4. Normal Ambient Operating Temperature: 40 deg C.

5. Open circuit operation will not reduce average life.

6. High-Pressure Sodium (HPS) Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.

7. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

8. All starters shall be epoxy filled with either a plastic or aluminum housing and shall provide six months of lamp open circuit operation without failure.

9. All compacitors shall be oil filled with self-contained internal protective device and bleeder resistor, and shall be housed in a corrosion-resistant steel can.

V. Fixtures utilizing ballasts or transformers for discharge type lamps shall each bear identification, by means of a label on the reflector or body, of the circuit voltage at which they are intended to be used.

W. Ballasts or transformers for discharge type lamps shall be suitable for operating the indicated lamps.

X. Fixtures utilizing ballasts, transformers and the like shall be designed so that surface temperatures of these components do not exceed 90°C when ambient temperature is 30°C.

Y. All ballasts or transformers for discharge type lamps shall be high power factor type.

Z. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when fixture is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60 percent light output.

AA. Incandescent Fixtures: Conform to UL 1571.

AB. All recessed incandescent lighting fixtures shall incorporate integral thermal protection.

AC. Track-Lighting Systems: Conform to UL 1574. Provide components, including track, fittings, and fixtures, from same manufacturer and as recommended by manufacturer for intended use.

AD. They shall be complete with all internal wiring and all flexible conduits, pigtails, and the like necessary for external connections.

AE. Grounding type flexible conduit shall be used for lighting fixture pigtails, and grounding type connectors shall be used for installing same. Include grounding conductor if upstream overcurrent device exceeds 20 amps.

AF. All wire utilized for connections to or between individual lamp sockets and lamp auxiliaries (i.e., wires which do not constitute "through circuit" wiring) shall be minimum #16 gauge, industry standard, fixture wire suitable for the temperature, current and voltage conditions to which it is subjected.

AG. Internal wiring shall contain a minimum number of splices.

AH. Splices in internal wiring shall be made with approved insulated "wire nut" type mechanical connectors, suitable for the temperature and voltage conditions to which they are subjected.

AI. Exit Signs: Conform to UL 924 and the following:

1. Sign Colors: Conform to local code.

2. Minimum Height of Letters: Conform to local code.

3. Arrows: Include as indicated.

2.3 LAMPS

A. Comply with ANSI C78 series that is applicable to each type of lamp.

B. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 3500 K and 85 CRI, except as otherwise indicated.

1. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.

2. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.

3. All lamps shall be manufactured by GE, Osram/Sylvania, or Philips.

2.4 FINISHES

A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

B. Their finishes shall be as selected by the Architect.

C. Where the Architect issues no instructions pertaining to finishes, supply standard finishes except abide by the following:-

1. Unpainted non-reflecting surfaces shall be satin finished and coated with a baked-on clear lacquer to preserve the surface. Where aluminum surfaces are treated with an anodic process, the clear lacquer coating may be omitted.

2. Enamel coatings shall be of the high temperature baked-on type.

3. Porcelain enameled finishes shall meet or exceed R.L.M. standards in all respects.

4. Painted surfaces on fixtures for use outdoors or in damp locations shall exhibit weather and moisture resisting qualities equal to surfaces having epoxy based coatings. Unpainted aluminum shall be anodized.

5. Uncoated aluminum reflecting surfaces shall be treated with an alzak or anodizing process to insure a permanent reflective surface with a minimum 85% reflectance.

6. Enamel reflecting surfaces shall be white with 85% minimum reflectance.

2.5 LIGHTING CONTROLS

A. Lighting controls including - but not limited to - switches occupancy sensors, photoelectric sensors, time controls, dimmers, relays, panels and other miscellaneous devices shall be provided as part of the electric work.

B. With the exception of line voltage switches which are specified under "Wiring Devices," such devices are completely specified on the electrical drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 16 Section "Supports." Comply with additional seismic requirements.

B. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures: Units may be supported from suspended ceiling support system if support system is approved for such purpose.

1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.

2. Fixtures of Sizes Less than Ceiling Grid: Center in acoustical panel. Support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling support system ceiling tees.

C. Support for Suspended Fixtures: Brace pendants and rods over 48 inches (1200 mm) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with two stems. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end unless otherwise indicated.

D. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.2 CONNECTIONS

A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replaced damaged fixtures and components.

B. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.

C. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

D. Replace fixtures that show evidence of corrosion during Project warranty period.

E. All permanent light fixtures used for temporary light during the construction phase for a period over 1000 hours for fluorescent and HID sources and 100 hours for tungsten sources shall be relamped prior to acceptance.

3.4 ADJUSTING AND CLEANING

A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities. Aim fixtures as directed.

END OF SECTION

SECTION 16600 - SPECIAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Emergency Generator Set and Automatic Transfer Switches as per pre-purchase specifications.

1.2 RELATED WORK

A. Section 16050 - Basic Electric Materials, Methods and Requirements.

1.3 REFERENCES

A. New York City Electrical Code.

B. New York City Building Code (and Reference Standards).

C. ANSI/NEMA MG-1 - Motors and Generators.

D. ANSI/NEMA 250 - Enclosures for Electrical Equipment.

E. ANSI/IEEE 446 - Emergency and Standby Power Systems.

F. ANSI/IEEE 519 - Guide for Harmonic Control of Static Power Converters.

G. ANSI/NFPA 78 - Lightning Protection Code.

H. UL96A - Installation Requirements for Lightning Protection Systems.

I. P.A. Standards

1.4 QUALITY ASSURANCE

A. In order to define requirements for quality and function, product specifications designate manufacturers. Equivalent or better products of other unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in Specification Section 16050.

1.5 SUBMITTALS

A. Submit product data under provisions of Section 01300.

PART 2 - PRODUCTS

2.1 EMERGENCY ELECTRIC GENERATING SETS -- DIESEL ENGINE DRIVEN

A. See pre-purchase specifications.

2.2 AUTOMATIC TRANSFER SWITCHES

A. See pre-purchase specifications.

PART 3 - EXECUTION

3.1 CERTIFICATIONS

A. Submit manufacturers certifications as to equipment performance as specified in Part 2.

3.2 INSTALLATION OF EMERGENCY GENERATING SET

A. Include mounting of generator sets on base as described.

B. Include mounting of all non-integral components as described.

C. Include installation of load bank and controls as described.

D. Include circuitry runs and connections between all components as described.

E. Include breakglass shutdown of generator(s), located at entry to generator room as described.

F. Include initial fill of fuel in day tank.

G. See pre-purchase specifications.

3.3 INSTALLATION OF AUTOMATIC TRANSFER SWITCHES

A. Install automatic transfer switches as located on the drawings.

B. Adjust and set all relays and devices to provide all operating sequences in a safe and orderly manner. Submit settings for review prior to final field adjustment.

C. Provide all required wiring interconnections as described.

D. See pre-purchase specifications.

END OF SECTION

SECTION 16700 - COMMUNICATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Communication systems as described.

1.2 RELATED WORK

A. Section 16050 - Basic Electric Materials, Methods and Requirements.

1.3 REFERENCES

A. New York City Electrical Code.

B. New York City Building Code (and Reference Standards).

C. NFPA 101 - Life Safety Code.

D. NFPA 72A - Local Protective Fire Alarm Signaling Systems.

E. NFPA 72B - Auxiliary Protective Fire Alarm Signaling System.

F. NFPA 72C - Remote Station Protective Signaling System.

G. NFPA 72E - Automatic Fire Detectors

1.4 QUALITY ASSURANCE

A. In order to define requirements for quality and function, product specifications designate manufacturers.

1.5 SUBMITTALS

A. Submit product data.

PART 2 - PRODUCTS

2.1 MODIFICATIONS TO EXISTING FIRE PROTECTIVE ALARM SYSTEM

A. The existing Firecom fire alarm system shall be modified as required to accept the following new components.

1. Outlying smoke (and smoke-heat)sensor/detectors.

2. Outlying manual fire alarm stations.

3. Connection to new outlying sprinkler and fire standpipe alarm and supervisory devices.

4. Outlying (monitoring and control) relays for mechanical equipment.

5. Connection to preaction sprinkler systems.

6. Outlying loudspeaker stations; each with integrally mounted visual fire warning (strobe) as otherwise specified wired to separate strobe panel.

7. Outlying visual warning signals (strobes) and probe supply panel.

8. Interconnecting circuitry and control circuit extensions (i.e., final connections to controlled equipment from relay boxes).

9. All required reprogramming.

10. Removals of existing devices superseded by new work.

B. Early completion of the Fire Protective Alarm system modifications will be required so as to permit a certificate of occupancy to be obtained in a timely manner for the spaces affected, in accordance with a schedule established by the Architect.

C. The system shall comply with all applicable requirements of the Americans with Disabilities Act (ADA) of 1990.

D. The modifications to the existing system shall conform to all applicable portions of the Electrical Code, and to the Administrative Code of the City of New York, including Reference Standard RS 17a and other applicable Reference Standards.

E. All new equipment shall be approved by the Materials and Equipment Acceptance Division (M.E.A.) of the Building Department or by The Board of Standards and Appeals (BSA). The entire system modification shall meet with the approval of the Fire Department, the Building Department and all other agencies having jurisdiction.

F. The work of this section shall include the responsibility for all filings with the Building Department, Fire Department, and any other agencies having jurisdiction. Where filings require the engineer's signature, documents shall be submitted for his review and signature. This responsibility shall include preparing and furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms, as well as the payment of any required filing fees.

G. Permits necessary for installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included as part of the required work.

H. The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations, and for its operation as described hereinafter. No exclusion from or limitation in the symbolism used on the drawings or the language used in these specifications shall be interpreted as a reason for omitting any appurtenances or accessories required to enable the system to perform the specified functions.

I. Upon completion of the installation (and as directed by the Architect) the work shall include making all arrangements and providing any assistance necessary for inspection and test as required for approval by the Fire Department. Modifications, adjustments and/or corrective work necessary to obtain approval along with subsequent inspection and test resulting from the issuance of a "Notice of Defect" shall precede any consideration of formal acceptance by the Architect. In conjunction with the above, training as deemed necessary to instruct authorized building personnel in the proper operation of the system shall also form a part of the required work.

PART 3 - EXECUTION

NOT INCLUDED.

END OF SECTION

(1854.98\ELEC.SPC)

TABLE OF CONTENTS

1.0 STATEMENT OF WORK 1

1.1 General Description 1

1.2 Location 1

1.3 Applicable Specifications 1

2.0 REQUIREMENTS 2

2.1 General Requirements 2

2.2 Contractor Requirements 2
2.2.1 Vault Construction Requirements 2
2.2.2 Security Wall Construction Requirements 2
2.2.3 Special Door Requirements 4
2.2.4 Electromagnetic Filtering Requirements 4
2.2.5 Electronic Security System Specifications and Installation Guidelines 4
Figure 2-1. STANDARD MULTIPLEXER ENCLOSURE MOUNTING 6
Table 2-1. MULTIPLEXER WIRING CONNECTIONS 7
Table 2-2. TYPICAL DEVICE INTERCONNECTIONS 7
Figure 2-2. MULTIPLEXER BOARD PHYSICAL DETAIL 8
Figure 2-3. AMP. INTERNAL VIEW 10
Table 2-3. CABLE ENVIRONMENTS AND RECOMMENDATIONS 11
Table 2-4. TYPICAL AMP COMMUNICATION CABLE CONNECTIONS 11
Figure 2-4. THIRTY-TWO-ZONE CONTROL BOARD ELECTRICAL CONNECTIONS 12
Figure 2-5. AMP COMMUNICATION CABLE CONNECTIONS 13
Figure 2-6. ACS ENCLOSURE MOUNTING 17
Figure 2-7. ACS BOARD AND BATTERY INSTALLATION 18
Table 2-5. ACS TERMINAL BLOCK PIN DESIGNATIONS 20
Figure 2-8. ACS PIN KEYPAD INSTALLATION 24
Reader Heads & Keypads 25
FIGURE 2-9. KEYPAD CARD READER INSTALLATION 26
FIGURE 2-10. SCHEMATIC DIAGRAM OF VRP-5310 MOUNTING 28
FIGURE 2-11. WIRING DIAGRAM OF VRP-5310 29
Table 2-6. INTERFACE CONTROLLER CONNECTOR AND PIN FUNCTIONS 30
Table 2-7. KEYPAD READER CONNECTOR AND PIN FUNCTIONS 30
2.2.6 Close Circuit Television System (CCTV) 31
Table 2-8. CCTV WIRING 32

2.3 Specific Materials to be supplied 34
Table 2-9. ELECTRONIC SECURITY BILL OF MATERIALS 34
Table 2-10. CCTV BILL OF MATERIALS 35

3.0 ELECTRONIC SECURITY TASKS 36

3.1 Electronic Security Wiring Requirements 36

3.2 CCTV Mounting and wiring 36
Table 3-1. CCTV WIRING 36

3.3 Sensor Mounting and Wiring Requirements 36
FIGURE 3-1. END OF LINE RESISTOR WIRING 37
3.3.1 Balanced Magnetic Door Contacts 37
3.3.2 Motion Detectors 37
3.3.3 Smoke Detectors 37
3.3.4 Duress Switch 37
3.3.5 Duress Receiver 38
3.3.6 Portable Duress Alarm 38
3.3.7 Duct Alarms 38
3.3.8 Vibration Sensors 38

3.5 Card Reader and Alarm Wiring Requirements 39
Table 3-2. CARD READER AND ALARM WIRING REQUIREMENTS 39
Table 3-3. SENSOR WIRING REQUIREMENTS 41

1.0 Statement of Work

1.1 General Description

The successful bidder is required to supply and install specialized security equipment where indicated on the drawings. This will involve construction of walls to specifications using specified materials and providing Certificates of Compliance for the materials. Special security doors are to be installed where specified on the drawings. These doors will be supplied with the hardware shown on the drawings. The specified electronic security equipment will be supplied and installed. This consists of electronic sensors, card readers, alarm monitoring equipment, CCTV cameras and monitors, and their associated wiring. All efforts are to be coordinated with other disciplines the Architect, and Vikonics. The scope of work includes the cost of Vikonics to inspect and approve the bidder's efforts, system setup and calibration, database generation, and training of the client.

1.2 Location

The site is located at Seven World Trade Center and covers the entire 23rd floor, part of the 1st and 7th floors, and a radio room on the roof.

1.3 Applicable Specifications

UL 752	Bulletproof Doors
DIAM 50-3	Defense Intelligence Agency Manual
DCID 1/21	Director of Intelligence Directive
	National Electrical Code
	NYC Building Code

2.0 Requirements

2.1 General Requirements

The contractor will supply all materials and labor required to complete the work shown on the drawings. All work is to be performed in accordance with applicable building codes. Materials specified herein (by Manufacturer and Model number) are the only approved materials. All wire used will be UL and NYC approved and as specified. Certain areas will require wire and cables associated with the security system to be run in ridged conduit. The particular wire runs are noted on the wiring tables. All installation is to be performed to Manufacturer's instructions. The contractor shall maintain a set of redline drawings showing any approved deviations from the original contract drawings. The drawings are to be submitted to Vikonics fifteen (15) days after completion of the work.

2.2 Contractor Requirements

The requirements are detailed in the following paragraphs. The contractor must provide evidence of compliance to the requirements. At a minimum, the Contractor is required to check continuity of all cables installed by the Contractor. All work that is to be concealed must be inspected, tested, and approved before concealment. All required tests are to be conducted by the contractor and the results provided with notification that the task is ready for verification. The contractor shall provide a minimum of 24 hours notice of inspections to be performed. All cables must be identified with permanent markers per the numbers in the wiring table. Markers are to be applied 6" from the cable ends and be visible in the terminating enclosure. Service loops (12" minimum in excess of termination lengths) are to be provided at both ends of cables.

System interconnect is shown on Riser Diagram 038Z001.

2.2.1 Vault Construction Requirements

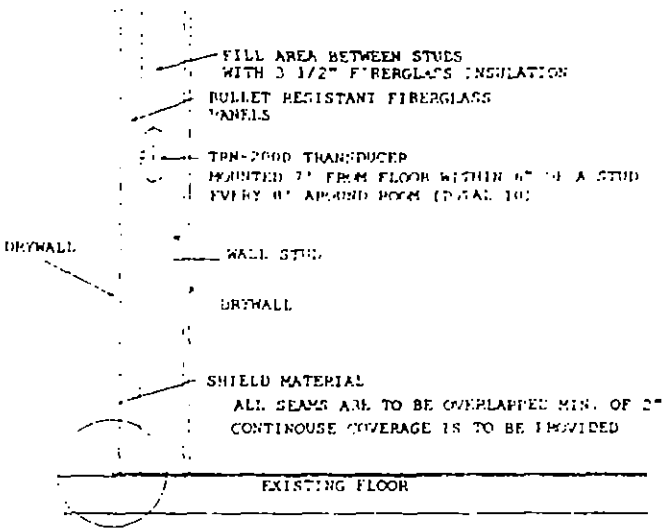
Vault construction will be of steel alloy-type, 1/4" thick, having characteristics of high yield and tensile strength. The metal plates are to be continuously welded to load-bearing steel members of a thickness equal to that of the plates. Floor and ceiling will be of the same construction. The vault shall be equipped with a GSA approved Class 5, Class 6 or Class 8 vault door.

2.2.2 Security Wall Construction Requirements

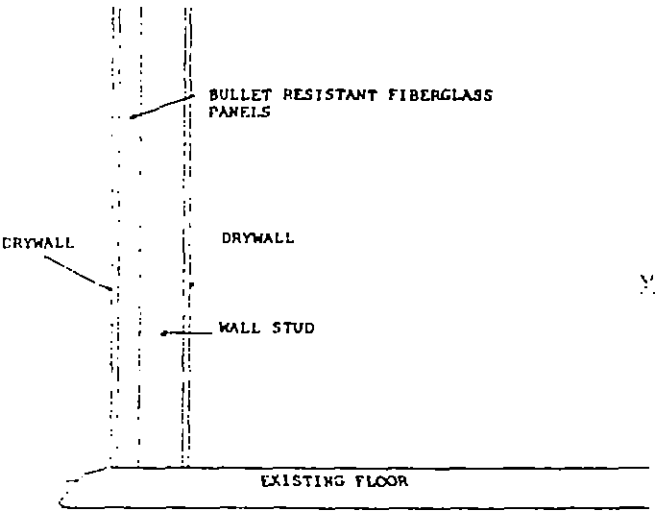
Walls designated on the drawings as security walls are to be constructed from deck to deck. Some walls will be constructed of a bullet resistant material and require EMI shielding. Audio attenuation will also be required in this wall construction as well as sound masking.. TRN-2000 transducers are manufactured by Research Electronics International Cookeville, TN.

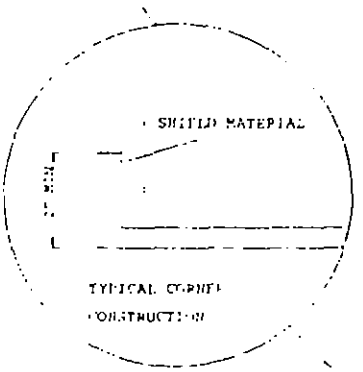
Any openings in the wall larger than 90 square inches must be filled with appropriate intrusion prevention and detection equipment. This includes HVAC ducts and cable entry points. Shielding material and bullet resistant panels are as specified on the drawings. TRN-2000 transducers are manufactured by Research Electronics International Cookeville, TN.

SOUND, EMI AND BULLET RESISTANT WALL CONSTRUCTION

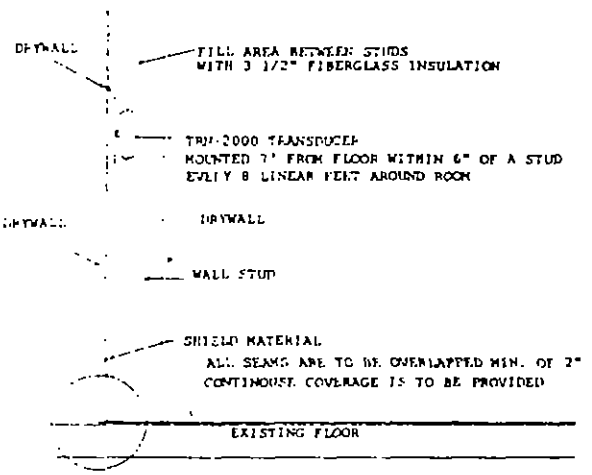


BULLET RESISTANT WALL CONSTRUCTION

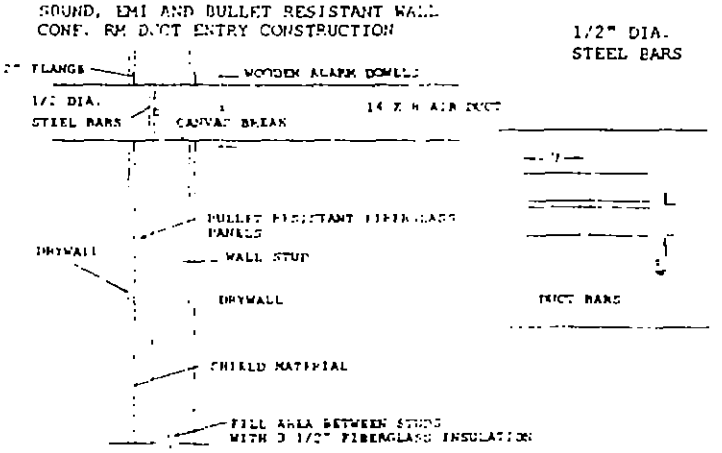




SOUND AND EMI RESISTANT WALL CONSTRUCTION



SOUND, EMI AND BULLET RESISTANT WALL
CONF. RM DUCT ENTRY CONSTRUCTION



2.2.3 Special Door Requirements

Special door construction is required where shown on the drawings. The door supplier is listed in the wiring section.

2.2.4 Electromagnetic Filtering Requirements

The area occupied by the Mayor and Commissioner is to be considered a Sensitive Compartmented Information Facility (SCIF). This requires techniques and materials to prevent electromagnetic intelligible emanations from leaving the area. The power line feed entering the area will require an isolation transformer and low pass filters. The shielding materials and the steel vault must be tied to earth ground.

2.2.5 Electronic Security System Specifications and Installation Guidelines

The following paragraphs provide a description of the components that comprise Vikonics' VISIDS Security system. This is included to provide a functional understanding of the system components. Locations for all security devices are shown in Drawings 038L001 and 038L002. Physical sizes and power requirements are shown in the Bill of Materials.

2.2.5.1 The VISIDS System

The VISIDS integrated security systems provides physical security by integrating access/entry control, intrusion detection, visual assessment (closed circuit television) and Photo I.D.

The VISIDS network is an intuitive distributed system with the VISIDS computer serving as the Central Processing Unit (CPU). The CPU, with its integrated software package, controls the network, local subsystems, and all system activities. The VISIDS 3500 can support expanded configurations with multiple operator workstations (VISIDS 3550) and TAC/NCM-B Front End Processors.

The VISIDS 3500 is to be located in the console in Room 23-18. Each of the three VISIDS workstations (VISIDS 3550) are to be located in Room 23-52. See the Table below for wiring requirements.

FROM		TO			
Device	Location	Device	Location	Wire #	Wire Req.
VISIDS 3500	RM 23-18	VP-3570 HUB	RM23-52	101	Cat 5 lan Cable
VISIDS 3550 OT2	RM 23-52	VP-3570 HUB	RM23-52	102	Cat 5 lan Cable
VISIDS 3550 OT3	RM 23-52	VP-3570 HUB	RM23-52	103	Cat 5 lan Cable
VISIDS 3550 OT4	RM 23-52	VP-3570 HUB	RM23-52	104	Cat 5 lan Cable
VISIDS 3500	RM 23-18	TAC/NCM	RM23-18	105	Phone Cable w/ RJ11 plugs

2.2.5.2 THE TAC-NCM

The TAC/NCM-B series units serve as the front-end processors for the VISIDS central CPU units. The TAC/NCM-B is will be mounted on plywood in Room 23-18.

Typical TAC/NCM Connections	
TAC Polling Channel	Multiplexer J17
RX+ 1	1 TX+
RX– 9	2 TX–
TX+ 11	3 RX+
TX– 10	4 RX–

2.2.5.3 VP-2260 Multiplexer

Vikonics' multiplexer collects data from remote terminals (intrusion detection and entry control interfaces) and transmits the data back to the central processor for annunciation, logging, and reporting. The multiplexers will be located in Rooms 23-18 and 23-50 (see Drawing 038L003). Installation procedures are detailed below.

SITE PREPARATION

Be sure the following has been completed before connecting the Multiplexer:

- A dedicated AC circuit (when the transformer will be used) or a Low Voltage Power Supply for the Multiplexer has been installed near the enclosure location.
- Two twisted pairs of wire have been run from the Multiplexer location to the TAC location and to each peripheral location.

MOUNTING PROCEDURES

STANDARD ENCLOSURE MOUNTING

The PC Board is shipped mounted on plastic stand-offs inside the enclosure.

The enclosure is mounted to a wall, inside a secure area, through four (4) mounting holes in the base (see Figure 2-1). If used, the power transformer is mounted either on the side of the enclosure cover or in the ceiling above. See the steps below to mount the enclosure:

1. Unhinge the front panel from the rear panel.
2. Determine a location for the Multiplexer where it can be securely mounted to a wall and have access to an earth ground.
3. Create wire-routing access hole(s) by selecting and carefully removing rear panel and/or bottom panel knock-out disk(s). If necessary, remove the PC board from the rear panel temporarily to protect it from damage during this process.
4. Cut wire chase holes in hollow wall . If mounted on solid wall, holes should be cut in enclosure on bottom for wiring.
5. Connect a 16 AWG or larger size wire with a spade lug to one of the nuts or studs on the back of the rear panel. Connect the other end of the wire to a suitable earth-ground point.
6. Mount the rear panel to the wall using the four 0.196" (5 mm) corner holes. Be sure to use mounting screws that are appropriate for the mounting surface, and to fasten them securely to the wall.
7. Pull wires into enclosure; leave a service loop.
8. Re-Hinge the front panel onto the rear panel.
9. Mount MUX to standoffs if removed earlier.
10. If used, mount the transformer to side of the enclosure or above the ceiling in a secure location (power connections are described later).
11. If the unit is equipped with a tamper switch, the tamper switch must be connected to a local alarm panel.

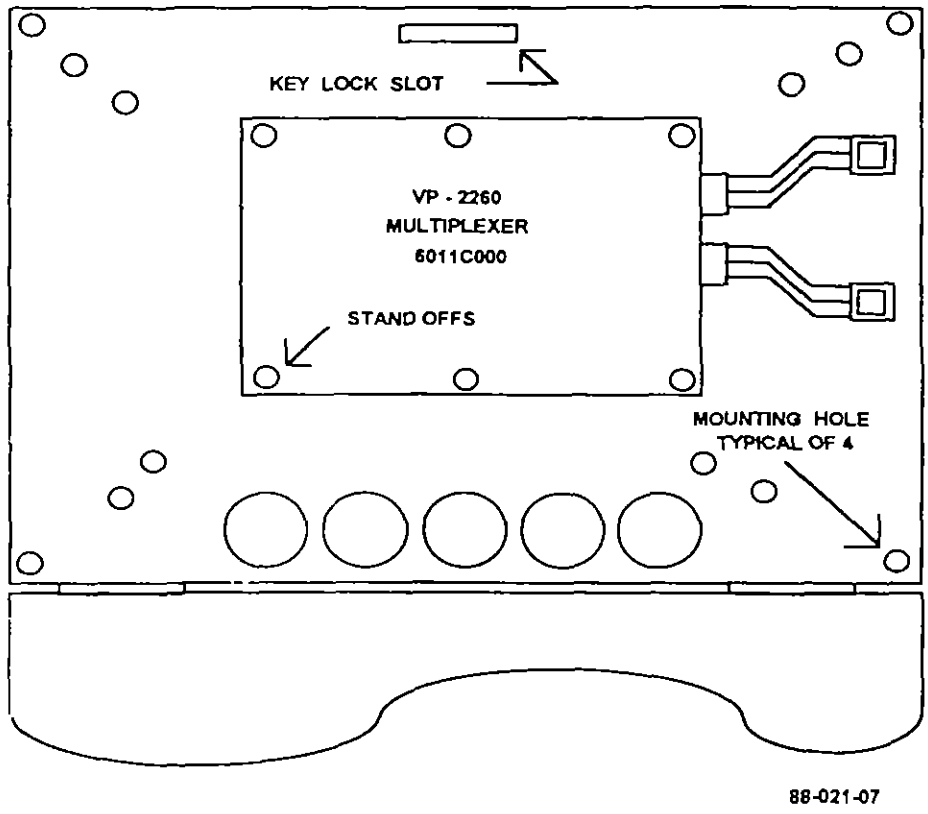


FIGURE 2-1. STANDARD MULTIPLEXER ENCLOSURE MOUNTING

INTERCONNECTIONS

Three types of interconnections are required to install the Multiplexer (see Figure 2-2) as follows:

- Data connections to and from TAC
- Data connections to and from Peripherals
- Power connections to MUX and Transformer or Power Supply.

All wires to and from the Multiplexer are fed through holes at the rear or lower base of the enclosure. These wires are from various peripherals located throughout the facility and from the TAC or Modem. All device connections to the Multiplexer are via 4-pin Molex type connectors. Connections at the TACs and peripheral devices vary: consult the appropriate device manual.

Notes:

1. All Multiplexer interconnect shielded cables should have shields grounded at one end only. Normally, this should be the end of the cable closest to the TAC.
2. Voltage regulators (which normally are mounted prior to delivery) must have the mounting plate thermally connected, but electrically isolated from the enclosure. Nylon screws normally are utilized to secure the regulators.

DEVICE INTERCONNECTIONS

Tables 2-1 and 2-2 provide device wiring connections for the TAC and various peripherals respectively.

POWER CONNECTION

The Multiplexer requires 8 Vac or 12 Vdc power. This is applied to connector J18 Pins 1 and 3 (no polarity) using a 3 pin Molex connector.

TABLE 2-1. MULTIPLEXER WIRING CONNECTIONS

Connector	Pin	Description
J1 to J16		**Peripheral I/O, 20mA Type**
	1	TX+, Transmit Data, Positive
	2	TX–, Transmit Data, Negative
	3	RX+, Receive Data, Positive
	4	RX–, Receive Data, Negative
J17		**TAC I/O, 20mA Type**
	1	TX+, Transmit Data, Positive
	2	TX–, Transmit Data, Negative
	3	RX+, Receive Data, Positive
	4	RX–, Receive Data, Negative
J18		**Power Connection, Low Voltage AC or 12 Vdc**
	1	8 Vac or 12 Vdc/Ground*
	2	No Connection
	3	8 Vac or Ground/12 Vdc*

*No polarity

TABLE 2-2. TYPICAL DEVICE INTERCONNECTIONS

Typical TAC/NCM Connection	
TAC Polling Channel	Multiplexer J17
RX+ 1 RX– 9 TX+ 11 TX– 10	1 TX+ 2 TX– 3 RX+ 4 RX–
Typical Peripheral Connections **Applies to: ACP, ACS, AMP, and CRI Controller** **(also applies when linking Multiplexers)**	
Peripheral Polling Channel	Multiplexer J1 to J16
RX+ 3 RX– 4 TX+ 1 TX– 2	1 TX+ 2 TX– 3 RX+ 4 RX–

Notes:

1. See specific TAC and peripheral device manuals to confirm device connections and for cable connection type (15 pin D-type, 25 pin D-type, etc.)
2. See specific communication device (modem, line driver, level converter, line security device) manual for device connectors.

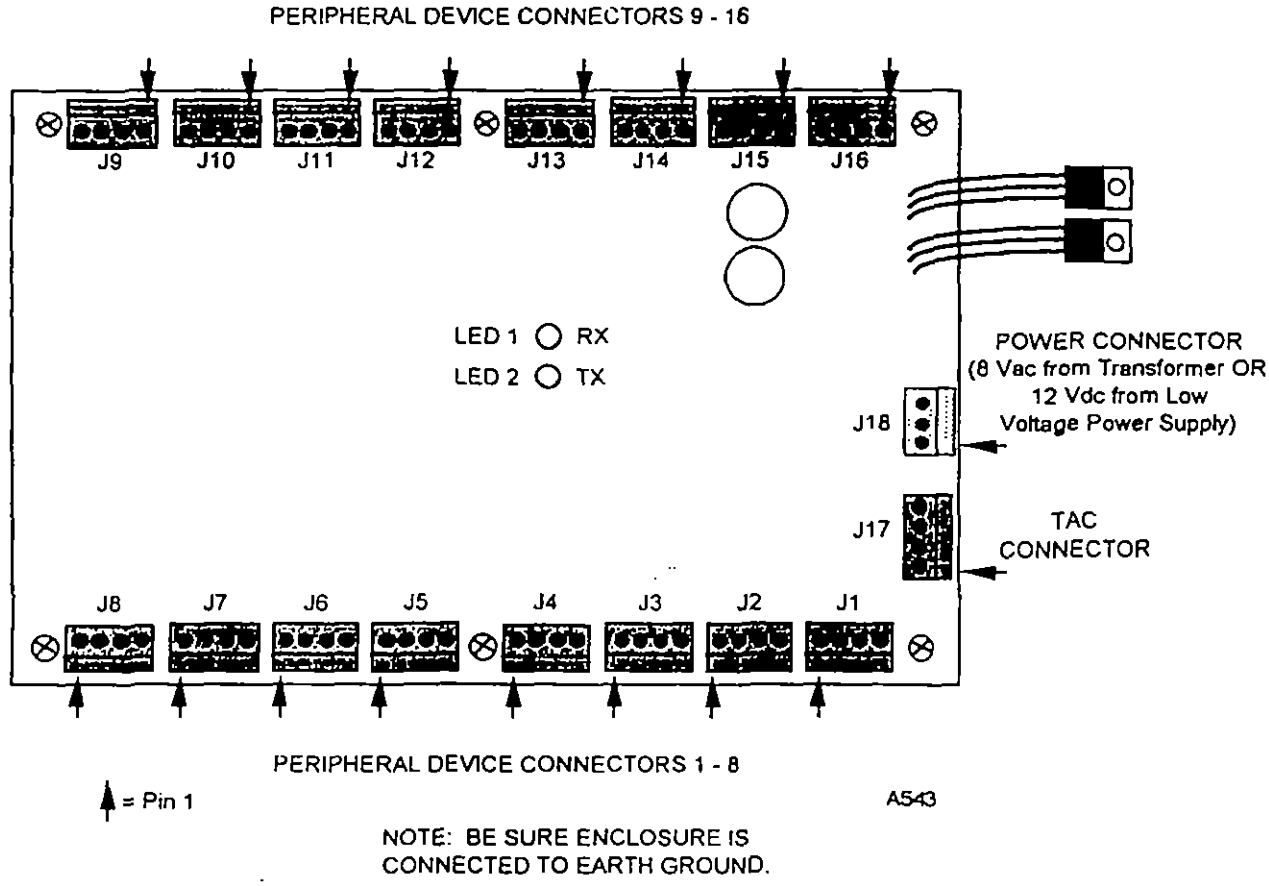


FIGURE 2-2. MULTIPLEXER BOARD PHYSICAL DETAIL

2.2.5.4 Alarm Monitor Panels (VP-2216 & VP-2232)

Vikonics Alarm Monitor Panel (AMP) monitors alarm/sensor zones and reports changes in status to a TAC Front-End Processor. The central processor continually "polls" the alarm panel and a change in status of any alarm contact will send an alarm to the processor. The panel provides line supervision and four (4) relays as outputs. Each zone can be connected to any type of dry contact sensor, which can be provided with Vikonics end-of-line supervision networks. Sensors can include door contacts, motion, and noise or vibration sensors.

Wiring requirements are shown in Table 3-2.

The AMPs will be located in Rooms 23-18 and 23-50 (see Drawing 038L003).

STANDARD-ENCLOSURE MOUNTING PROCEDURE

Refer to Figure 2-3 during the following procedure.

1. Note the polarity of the power jumper wires in their TB9 screw terminals at the top-right corner of the control board, then unscrew them.
2. If the AMP has an enclosure tamper switch, note the control-board alarm-zone input to which the tamper-switch is connected, then unplug it.
3. Unhinge the front panel from the rear panel.
4. Create wire-routing access hole(s) by selecting and carefully removing rear-panel and/or top-panel knock-out disk(s). If necessary, temporarily remove the control board from the rear panel to protect it from damage during this process.
5. Locate the AMP where it can be securely mounted to a wall and have access to an earth ground.
6. Connect a 16 AWG or larger size wire with a spade lug to one of the nuts or studs on the back of the rear panel. (Remove paint to provide good electrical connection.) Connect the other end of the wire to a suitable earth-ground point.
7. Mount the rear panel to the wall using the four 0.196" (5 mm) corner holes. Be sure to use mounting screws that are appropriate for the mounting surface, and to fasten them securely to the wall.
8. Re-hinge the front panel onto the rear panel.
9. Reconnect the enclosure-tamper-switch connector to the control-board alarm-device input.

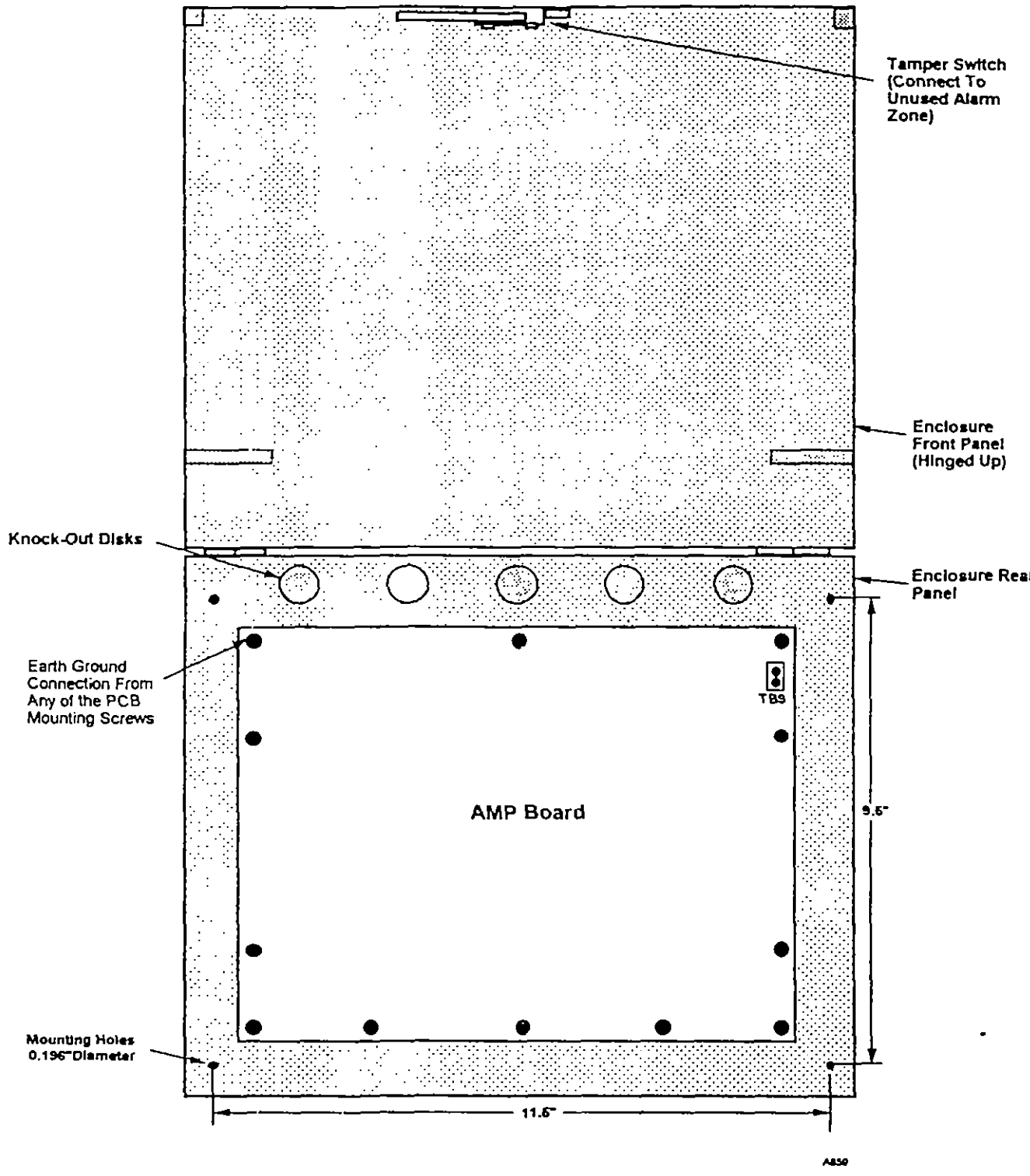


FIGURE 2-3. AMP, INTERNAL VIEW

ELECTRICAL CONNECTIONS

CAUTION: DO NOT connect power wires to the AMP until after all communication and zone-device connections have been made, and all jumper settings have been selected.

Refer to Control Board Electrical Connections Figure 2-4 during the following procedures. Route all cables and wires through the rear-panel knock-out holes. Leave a service loop in all cables and arrange them so that they don't exert any pressure on the circuit board or cables when the enclosure cover is closed.

NETWORK COMMUNICATION WIRES

The AMP communicates with network devices such as multiplexers, modems, Line Security Devices (LISDs or DES Encryptors), and/or TACs via two twisted pairs of wires in a shielded cable. One pair is for transmission (Tx) and the other is for reception (Rx). Different environments require different cable types. Table 2-3 shows four environments and the recommended cable for each.

TABLE 2-3. CABLE ENVIRONMENTS AND RECOMMENDATIONS

Environment	Recommended Cable
Conduit-enclosed, low electrical noise	Belden type 8723 or equivalent
Conduit enclosed, high electrical noise	Belden type 8728 or equivalent
Non-enclosed, low electrical noise	Belden type 88723 or equivalent (plenum rated)
Non-enclosed, high electrical noise	Belden type 87723 or equivalent (plenum rated)

The AMP's Rx and Tx screw-terminal connector TB10 is located at the bottom center of the control board. Connect the wires to TB10 as shown in Figure 2-5: Connect the AMP's TX+ and TX– outputs to the network device's RX+ and RX– inputs respectively, and connect the AMP's RX+ and RX– inputs to the network device's TX+ and TX– outputs respectively.

Table 2-4 shows typical AMP to network device connections; for other network device connections, see the appropriate technical manual.

TABLE 2-4. TYPICAL AMP COMMUNICATION CABLE CONNECTIONS

ACP TB10	to	VP-2260 Multiplexer	or	VP-2260-C Multiplexer	or	TAC/NCM and TAC-2010
Pin 1, Tx+		Pin 3, Rx+		Pin 4, Rx+		Pin 1, Rx+
Pin 2, Tx–		Pin 4, Rx–		Pin 3, Rx–		Pin 9, Rx–
Pin 3, Rx+		Pin 1, Tx+		Pin 1, Tx+		Pin 11, Tx+
Pin 4, Rx–		Pin 2, Tx–		Pin 2, Tx–		Pin 10, Tx–
4-Position Screw Compression Connector		4-Position Crimp Terminal Connector		4-Position 616 Std. Telephone Connector		15-Pin Male D-Connector

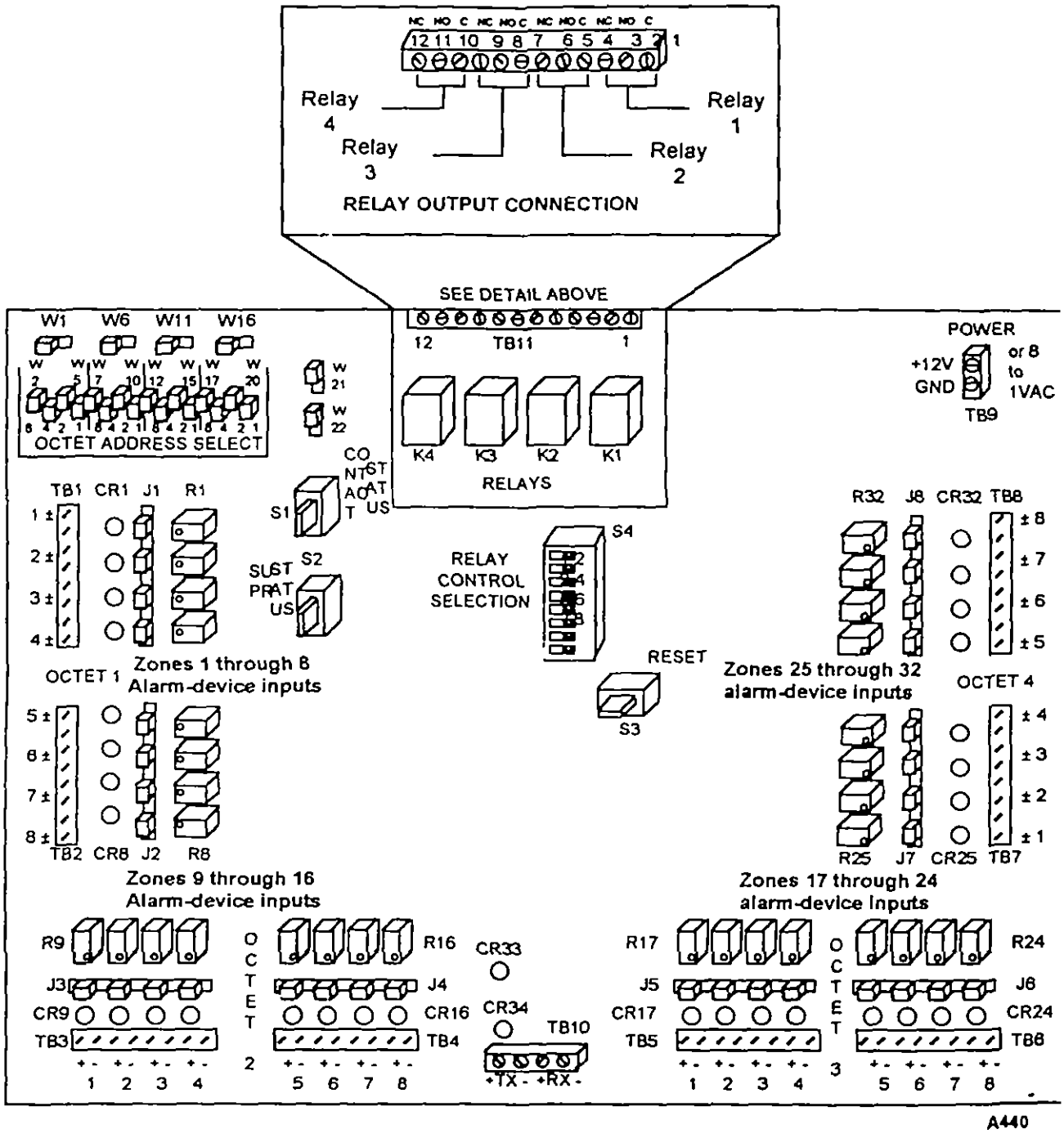


FIGURE 2-4. THIRTY-TWO-ZONE CONTROL BOARD ELECTRICAL CONNECTIONS

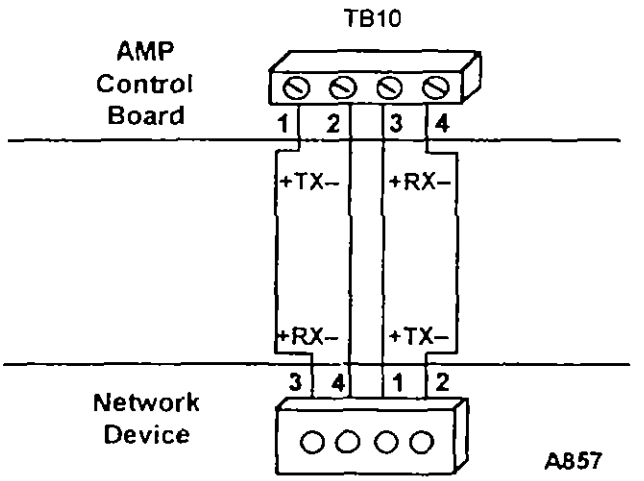


FIGURE 2-5. AMP COMMUNICATION CABLE CONNECTIONS

ALARM-ZONE CONNECTIONS

More than one alarm device can be connected to each zone. When connecting alarm devices to an alarm zone with line supervision, connect no more than one device containing the supervision resistor network to each zone.

Alarm-Zone Connections for 16-Zone AMP (VP-2216)

The alarm devices connect to the 16-Zone AMP control board via terminal blocks on the board's left and bottom-left sides. Connect the alarm devices corresponding to Zones 1 through 8 to Octet 1 (TB1 and TB2) on the board's left side, and the devices corresponding to Zones 9 through 16 to Octet 2 (TB3 and TB4) on the board's bottom-left side.

Alarm-Zone Connections for 32-Zone AMP (VP-2232)

The alarm devices connect to the 32-Zone AMP control board via terminal blocks on the board's left, bottom-left, bottom-right, and right sides. Connect the alarm devices corresponding to Zones 1 through 8 to Octet 1 (TB1 and TB2) on the board's left side, the devices corresponding to Zones 9 through 16 to Octet 2 (TB3 and TB4) on the board's bottom-left side, the devices corresponding to Zones 17 through 24 to Octet 3 (TB5 and TB6) on the board's bottom-right side, and the devices corresponding to Zones 25 through 32 to Octet 4 (TB7 and TB8) on the board's right side.

RELAY CONNECTIONS

The detail view of the relay connectors in Figure 2-4 shows the three possible connection points for each of the relays:

C = Common – always connect to one wire

NO = Normally Open – connect second wire if device is to be "on or connected" when relay is energized – that is, during an abnormal condition such as an alarm or panel off-line condition

NC = Normally Closed – connect second wire if device is to be "on or connected" when relay is not energized – that is, during a normal condition.

Note: NO and NC refer to the relay output with the relay coil in the de-energized condition.

During normal on-line operation, the relays are de-energized and the normally closed (NC) contact is connected to common (C). Then, depending on the switch configuration shown later, when relays are programmed for Local AMP control and certain events occur, the relays are energized and the normally open (NO) contact is connected to common (C). This means that, for example, if you want a siren to sound only when one of the specified events occurs, you would connect the siren wires to the "C" and "NO" terminals.

Relays also can be controlled via the central CPU.

2.2.5.5 Alarm Control Subsystem (ACS)

The ACS is an IDS interface designed for areas where remote secure/access capability is required *and* there is a need to know *who* placed the area into secure/access. The ACS is continuously "polled" by the IDS system software at a command center to determine current status. Any change of status of a sensor or a secure/access (S/A) device is immediately reported to the ACS and to the integrated security system at a command center.

Each zone can be connected to a dry contact sensor equipped with a Vikonics end-of-line device (VA-055); this provides the necessary components for alarm zone line supervision. The standard ACS model includes a tamper-protected enclosure, low voltage power supply, and a secure/access PIN keypad.

The ACS's will be located on the 23rd floor in Room 23-16, in the Radio Room on the roof, and in the Water Storage Room on the 7th floor. Conduit from the 7th floor and the roof to the 23rd floor will be provided but is not included in the Security Specification.

2.2.5.6 Intelligent Secure/Access Keypad (VP-1064)

The keypad device allows personnel to access and secure certain alarmed areas locally from within an alarmed area. Each keypad device will be wall mounted in a 4x4 gang box and conduit to be run to the ACS.

INSTALLATION OVERVIEW

Physical and electrical installation of the ACS consists of four main parts:

1. Physical installation and assembly of the ACS and interconnection of the sensors, relays, keypad and power with the ACS

2. Installation of the keypad

3. Programming of the ACS parameters via on-board DIP switches, jumper wires, and the keypad

4. Initial power-up, calibration, and troubleshooting.

Before beginning installation, determine the following:

1. Where the sensors and relay controlled devices (if any) will be installed, where in the protected area the ACS will be installed, where the keypad will be installed and how the devices will be connected (cable, conduit, etc.).

2. What type of communication cable will be required for the communication link; see typical choices below:

Environment	Recommended Cable
Conduit-enclosed, low electrical noise	Belden type 8723 or equivalent
Conduit-enclosed, high electrical noise	Belden type 8728 or equivalent
Non-enclosed, low electrical noise	Belden type 88723 or equivalent (plenum rated)
Non-enclosed, high electrical noise	Belden type 87723 or equivalent (plenum rated)
Conduit-enclosed fiber	Belden type 225702; 227712 or equivalent
Non-enclosed fiber	Belden type 225851; 225872; 227861; 227822 or equivalent (plenum rated)

Unpack the units and verify that the necessary items have been received in good condition. Note that the ACS is shipped in several parts to prevent damage. The ACS board is shipped in protective packing material within the enclosure. The keypad and battery are each shipped separately. Necessary ACS hardware (for securing the board and battery) is provided in a kit.

ACS INSTALLATION AND ASSEMBLY

The standard ACS is provided in a steel enclosure. Follow the procedures below when installing the standard enclosure unit:

1. Unlock and open the ACS enclosure cover.
2. Remove the ACS printed circuit board from the enclosure. Note that the tamper switch, AC input and battery terminal blocks are pre-wired.
3. Determine a location where the ACS can be securely mounted and where the conduit can be fitted properly.
4. Prepare wall/mounting material (obtain proper hardware and reinforcing material if necessary) such that the fully configured unit, which can weigh up to 20 pounds, can be securely fastened.
5. Determine the locations for the mounting hardware (see Figure 2-6).
6. Mark and knock-out or drill conduit entry location on enclosure.
7. Install conduit fittings.
8. Mount enclosure to wall — be sure it is securely fastened.
9. Install conduit and pull sensor, communication, keypad, relay controlled devices, and power wires into enclosure. Leave service loop.
10. Refer to Figure 2-7 and install ACS board on mounting plate using supplied hardware (eight total #6-32 x 1/4 " screws).
11. Connect the wires (yellow) from TB1 to the tamper switch NO and C connection points.
12. Connect the power wires (orange) from TB12 to the upper/outer (secondary) F and S connection tabs of the transformer. **(Caution: Do NOT connect the 115 Vac power line wires at this time.)**
13. Install battery hold down bracket to the bottom section of the mounting plate as follows:
    a. Screw 3.5" threaded rod into center hole in mounting plate
    b. Install lock washer and hex nut to secure rod in position on plate

c. Install hex nut, lock washer, and nut near top of rod.

14. Install battery in position.

15. Insert "Z" bracket onto threaded rod. Screw standoff onto threaded rod. Adjust height of upper hex nuts and install standoff such that bracket holds battery tightly.

Do NOT connect battery at this time.

16. Connect the alarm/sensor wires to the + and – screw terminals of each of the terminal blocks as defined below:

a. TB3 — Alarms 1 to 4 (pins 1 to 8)
b. TB4 — Alarms 5 to 8 (pins 1 to 8)
c. TB5 — Alarms 9 to 12 (pins 1 to 8, ACS-16; labeled S/A 1 to 4 on PCB)
d. TB6 — Alarms 13 to 16 (pins 1 to 8, ACS-16; labeled S/A 5 to 8 on PCB).

Notes:

1) Table 2-5 shows the pin designations for all ACS connectors.
2) For ease of installation, remove the terminal blocks (orange blocks) from the ACS board, make wire connections, and press the blocks onto the board.
3) Be sure the end-of-line resistor networks are installed on the sensors if line supervision will be enabled.

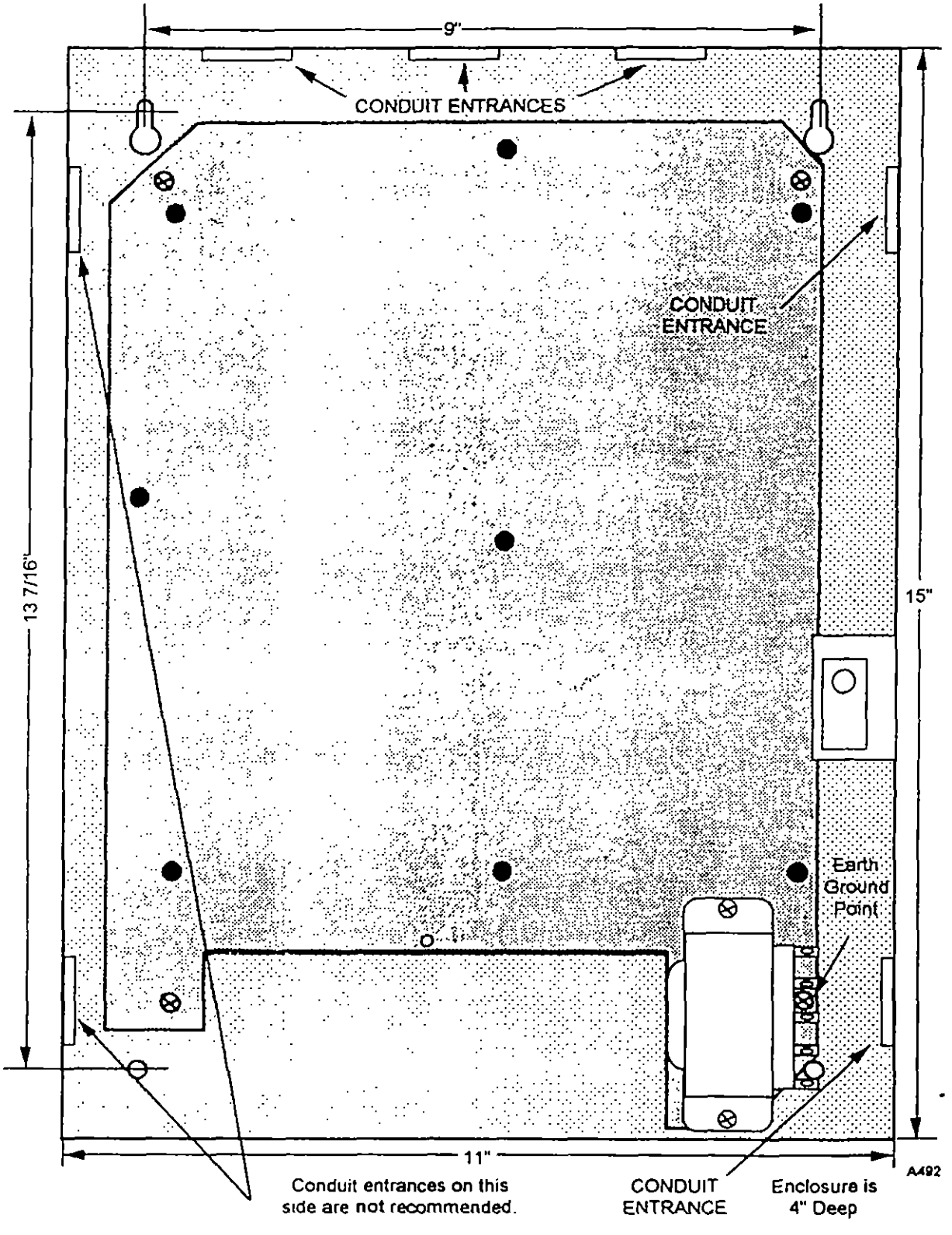


FIGURE 2-6. ACS ENCLOSURE MOUNTING

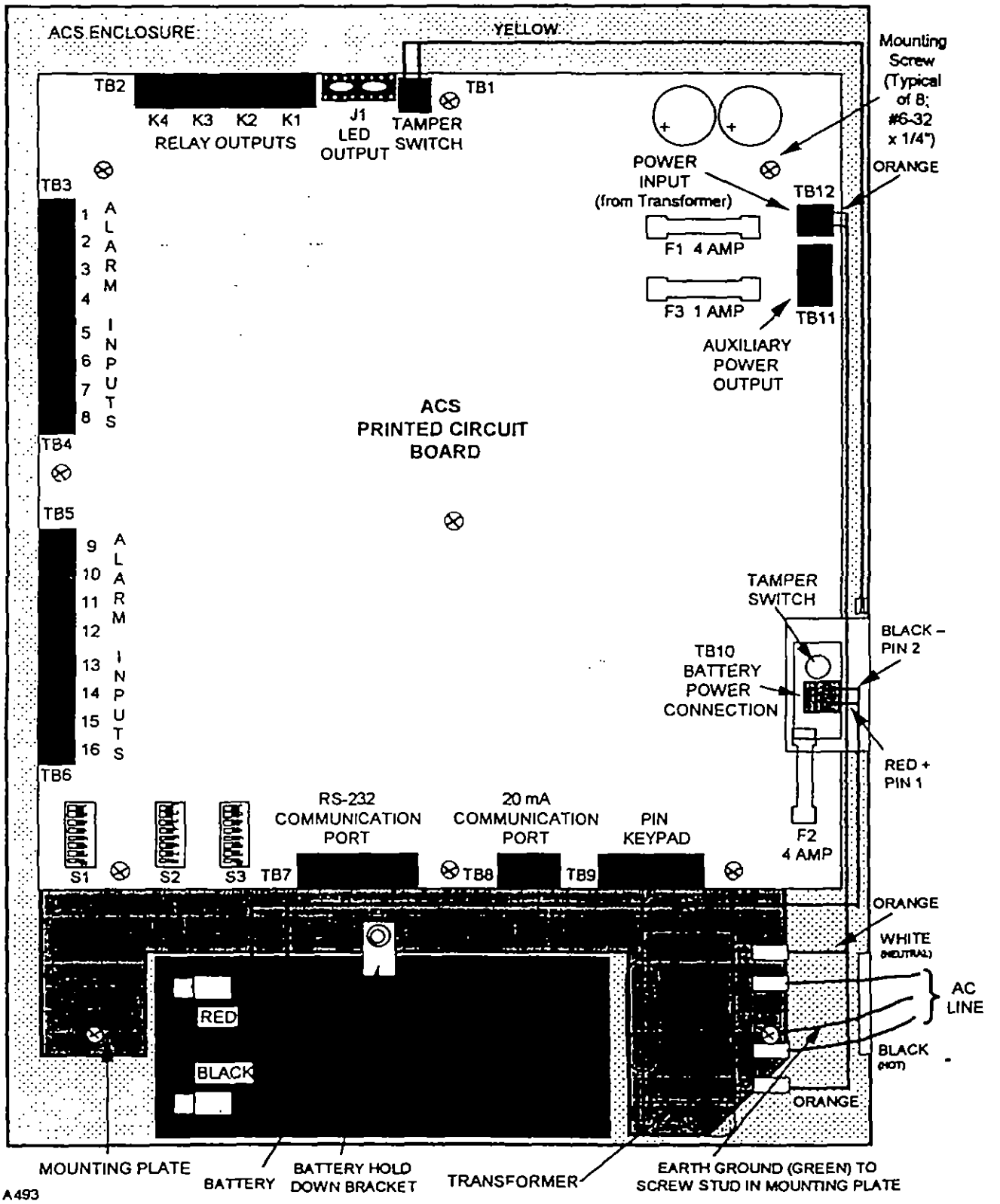


FIGURE 2-7. ACS BOARD AND BATTERY INSTALLATION

17. Connect the appropriate communication link cable: 20 mA current loop to TB8 or RS-232 to TB7. If using a 20 mA current loop interface connect the two-twisted pair as follows:

ACS	TB8	Multiplexer	or	TAC/NCM
1	TX+	RX+ 3		RX+ 1
2	TX-	RX- 4		RX- 9
3	RX+	TX+ 1		TX+ 11
4	RX-	TX- 2		TX- 10

See Table 2-5 if the RS-232 channel (TB7) is used.

18. Install the PIN keypad as described below.

19. Connect the cable for the PIN Keypad wires to TB9 as follows:

ACS TB9	SIGNAL	KEYPAD TB1
1	Clock	8
2	Data	5
3	Red LED	6
4	Green LED	7
5	+5 Vdc	3
6	Logic Ground	4
7	Tamper	2
	Earth Ground	1

20. Connect the relay output wires, if used, to the appropriate pins of TB2 as follows:

C = Common – always connect one wire
NO = Normally Open – connect second wire if device is to be "on or connected" when relay is energized — that is, during an abnormal condition such as an alarm or panel stand-alone operation condition
NC = Normally Closed – connect second wire if device is to be "on or connected" when relay is not energized — that is, during a normal condition.

Note: NO and NC refer to the relay output with the relay coil in the de-energized condition.

During normal on-line operation, the relays are de-energized and the normally closed (NC) contact is connected to common (C). Then, depending on the switch configuration shown later, when certain events occur, the relays are energized and the normally open (NO) contact is connected to common (C). This means that if you want a siren to sound only when one of the specified events occurs, you would connect the siren wires to the "C" and "NO" terminals.

21. If necessary, connect the power wires from remote sensors requiring DC power input to TB11. The ACS provides nominal 14 Vdc (up to 23 Vdc when operating from AC line power, down to 9 Vdc when operating from battery back-up nearing the discharge condition). The total current draw of the devices connected to this terminal block must be 400 mA or less; otherwise, the battery backup time will be reduced. Either or both outputs can be used to supply a total of 400 mA of power. Two power connections are possible via TB11:

Pin 1:	14 Vdc	Pin 3:	Ground
Pin 2:	14 Vdc	Pin 4:	Ground

TABLE 2-5. ACS TERMINAL BLOCK PIN DESIGNATIONS

Terminal Block	Pin	Description
TB1		Tamper Switch Input
	1	Tamper Switch +
	2	Tamper Switch –
TB2		Relay Outputs
	1	Relay 1 (K1) C
	2	Relay 1 (K1) NO
	3	Relay 1 (K1) NC
	4	Relay 2 (K2) C
	5	Relay 2 (K2) NO
	6	Relay 2 (K2) NC
	7	Relay 3 (K3) C
	8	Relay 3 (K3) NO
	9	Relay 3 (K3) NC
	10	Relay 4 (K4) C
	11	Relay 4 (K4) NO
	12	Relay 4 (K4) NC
TB3		Alarm Zone Inputs 1 to 4
	1	Alarm 1 + Signal
	2	Alarm 1 – Return
	3	Alarm 2 + Signal
	4	Alarm 2 – Return
	5	Alarm 3 + Signal
	6	Alarm 3 – Return
	7	Alarm 4 + Signal
	8	Alarm 4 – Return
TB4		Alarm Zone Inputs 5 to 8
	1	Alarm 5 + Signal
	2	Alarm 5 – Return
	3	Alarm 6 + Signal
	4	Alarm 6 – Return
	5	Alarm 7 + Signal
	6	Alarm 7 – Return
	7	Alarm 8 + Signal
	8	Alarm 8 – Return
TB5		Alarm Zone Inputs 9 to 12*
	1	Alarm 9 + Signal
	2	Alarm 9 – Return
	3	Alarm 10 + Signal
	4	Alarm 10 – Return
	5	Alarm 11 + Signal
	6	Alarm 11 – Return
	7	Alarm 12 + Signal
	8	Alarm 12 – Return

* Labeled on circuit board as S/A inputs 1 to 4

Table 2-5. ACS TERMINAL BLOCK PIN DESIGNATIONS
(continued)

Terminal Block	Pin	Description
TB6		Alarm Zone Inputs 13 to 16 *
	1	Alarm 13 + Signal
	2	Alarm 13 – Return
	3	Alarm 14 + Signal
	4	Alarm 14 – Return
	5	Alarm 15 + Signal
	6	Alarm 15 – Return
	7	Alarm 16 + Signal
	8	Alarm 16 – Return
TB7		Serial Communication (Polling) Port
	1	Earth Ground
	2	TX (Output)
	3	RX (Input)
	4	RTS (Output)
	5	CTS (Input)
	6	VB - Not Used
	7	Signal Ground
	8	V+ (10 V @ 5 mA)
TB8		20 mA Communication (Polling) Port
	1	TX+
	2	TX -
	3	RX+
	4	RX-
TB9		PIN Keypad Port
	1	Clock Output
	2	Data Input
	3	Red LED Drive
	4	Green LED Drive
	5	+5 Vdc Output
	6	Signal Ground
	7	Tamper Input
TB10		Battery Power Input
	1	Red + Input
	2	Black – Input
TB11		Auxiliary Power Output
	1	+ 14 Vdc (+9/- 5 Vdc)
	2	+ 14 Vdc (+9/- 5 Vdc)
	3	Return
	4	Return
TB12		AC Power Input
	1	Transformer Secondary #1
	2	Transformer Secondary #2

* Labeled on circuit board as S/A inputs 5 to 8

POWER CONNECTIONS

1. When the unit is ready for operation (i.e., to be connected to acc. power), connect the battery wires from TB10 as follows:

   a. Red to Positive (+) battery terminal (TB10 Pin 1)
   b. Black to Negative (–) battery terminal (TB10 Pin 2).

2. Connect earth ground to the mounting plate screw just to the right of the transformer.

3. Connect 120 Vac power input as follows:

   a. Neutral (white) to lower/inner (primary) F connection tab of the transformer
   b. Hot (black) to lower/inner (primary) S connection tab of the transformer.

PIN KEYPAD INSTALLATION

The PIN Keypad (VP-1064) is supplied with a faceplate suitable for mounting on a double-gang electrical box and with suitable mounting hardware (security screws). The PIN keypad can be installed on a standard double-gang box that has been recessed into the wall for a flush mount (or hidden wiring) installation. The keypad also can be installed on a "weatherproof" type double-gang box that has been installed on the wall for a surface (or exposed conduit) installation. The weatherproof box may also be used in post mount installations. After the double-gang box has been installed and the interconnecting cable (8 wires) has been brought into the box, install the keypad in accordance with Figure 2-3 and the steps below:

1. Set the keypad programming selections as described below.

2. Connect the routing wires from the ACS into the terminal block connector (TB1) of the keypad positions 2 through 8, as described in Item 19 above and per "Detail A" of Figure 2-8. Connect TB1 pin 1 to earth ground (rod or pipe).

3. Secure the keypad to the double-gang box using the supplied security screws. Ground the faceplate to earth ground using a wire connected to one of the security screws. Note: Before tightening screws, check that tamper switch trips as plate is positioned and removed from box; if necessary, gently bend tamper switch arm for proper operation.

PIN KEYPAD PROGRAMMING

PIN keypad programming should be accomplished prior to installation of the keypad. This programming determines the PIN set (keycode) to be used and the number of PIN entries that a user can attempt before generating an alarm.

PIN Set Selections (Keycodes)

Five sets of PINs (Personal Identification Numbers) are issued for each installation. The PIN assigned to each user is the four or five digit number that the user must enter on all PIN keypads in that system when securing/accessing the controlled areas (in addition to his/her user number). Five different sets of PINs are issued to allow the management of the facility to maintain security by changing the PIN set being used. The PIN set can be changed for specific PIN keypads (that is, some keypads can be configured for one PIN set and others for a different PIN set), or the PIN set can be changed for all keypads if there is a reason to suspect a security breach.

The PIN listing is shipped under separate cover to the security system manager, who should keep it in a secure location. The security manager then decides which of the five sets of PINs to use.

A copy of the selected PIN set should be given to the badging officer so that the correct PIN can be given to the users when they are assigned their user number and PIN.

To select the desire PIN set (1 to 5), use the 10-position switch (shown in Figure 2-8), located on the back of the PIN keypad board. An access hole is provided in the keyboard I/O board.

Keypad PIN Entry Attempts Setting

Depending on the PIN keypad set-up, the number of times a user can attempt to enter his/her PIN before an alarm is generated, is either 3 or 1; 1 is the default setting. Note: This applies to correct user number entries with incorrect PIN entries. This choice is set at a jumper wire located on the back of the keypad board (as described below. The I/O board must be removed from the keypad board to access the jumper wire.

Set Jumper ON:	Number of PIN Entry Attempts Before Alarm Occurs:
Middle and bottom pins	1
Middle and top pins	3

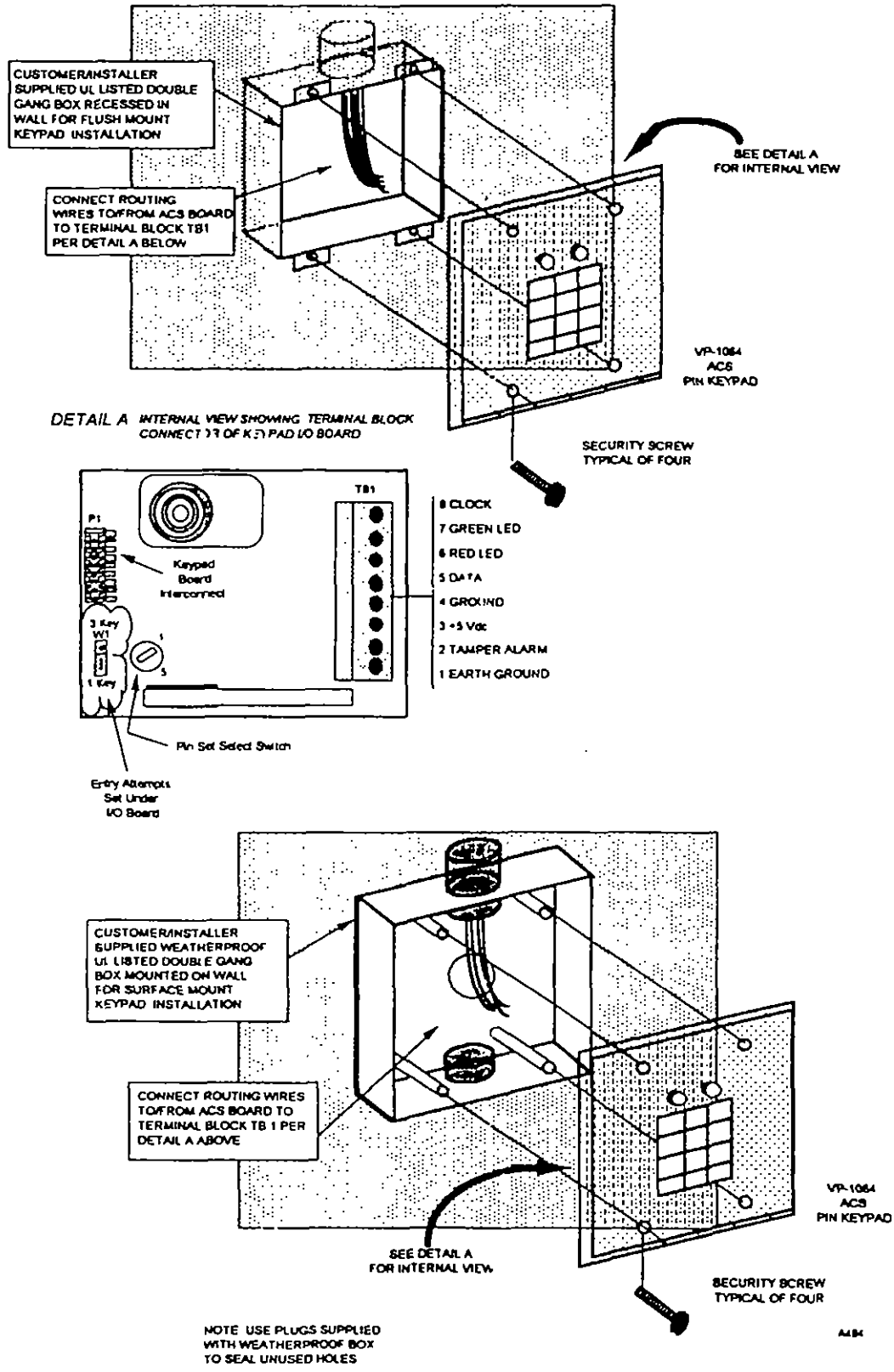


FIGURE 2-8. ACS PIN KEYPAD INSTALLATION

2.2.5.7 Card Reader Subsystem

Card Reader Interface (VRU-2004)

Five card reader interfaces (CRI) are to be installed – 3 in Room 23-18; 2 in Room 23-50. Wiring requirements are shown in Table 3-2.

The CRI also is capable of monitoring the door by way of a door contact that notifies the CRI whether the door is open or closed. The CRI can also be used with an egress button or other device, such as a motion detector, allowing users to exit from the area without the use of another reader.

Reader Heads & Keypads

The VRP-5310 Proximity Card Reader Head, with or without a VRI-2130 Keypad, is mounted to a double gang electrical box (surface or flush mount). The unit is powered from the card reader interface.

INSTALLATION OVERVIEW

Physical and electrical installation of the Card Reader Subsystem consists of three main parts:

1. Installation and configuration of the card readers and associated door hardware.
2. Assembly and installation of the interface controller.
3. Interconnection of the power, reader, and door hardware wiring to the interface controller.

Before beginning installation, determine the following:

1. Where the readers will be installed, where in the protected area the interface enclosure will be installed, and how the units will be connected (cable, conduit, etc.).
2.
2. Which model interface controller is being installed (two or four reader model) and how many readers will be connected. Unpack the units and verify that all necessary items have been received in good condition. Note that the interface controller is shipped in several parts to prevent damage.

3. How far – in terms of cable – the readers will be from the interface controller.

4. What type of power supply will be used for the interface controller, card reader, and door locking mechanism: Stepdown Transformer or Low Voltage Power Supply (LVPS-20/40); and where the power supply(ies) will be located. Note that the power cable to the door control hardware should be run separately from the communication cables.

5. The mounting locations and overall layout of the door hardware such as the door position sensor (for example, balanced magnetic switch) and the door control hardware (for example, door strike or magnetic lock). Refer to the detail drawings typically supplied as part of the installation package for additional information describing your specific installation (typically, detail drawings are contracted for and included with larger security installations).

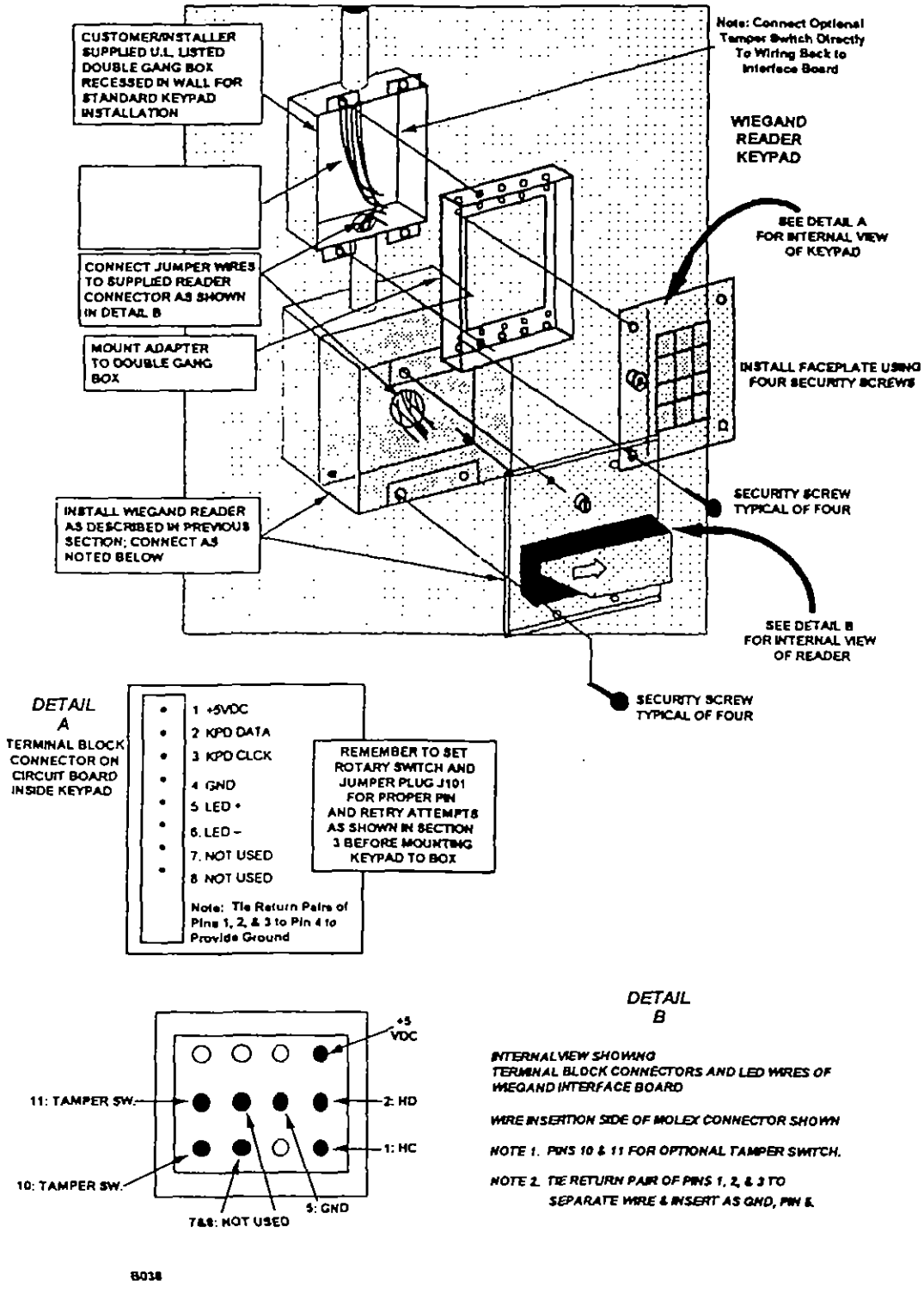


FIGURE 2-9. KEYPAD CARD READER INSTALLATION

STANDARD READER (VRP-5310) INSTALLATION.

This head is intended to be surface mounted on a wall. The head can be mounted directly on metal with only a slight decrease in read range but must not be framed in by a metal enclosure.

1.) See Figure 2-10 for mechanical dimensions of the head and mounting hole pattern. also, note the required hole for the pigtail wiring from the back of the head.

2.) See Figure 2-11 for detailed interconnect. This wiring should not be in the same conduit as A.C. power lock power (12" separation is desirable).

3.) Again, using the schematic diagram Figure 2-11, finish the interconnect to the card reader interface (VRU-200X).

4.) Lastly, apply power to the system. the head will beep a few times. indicating that it powered up correctly and the LED will glow amber.

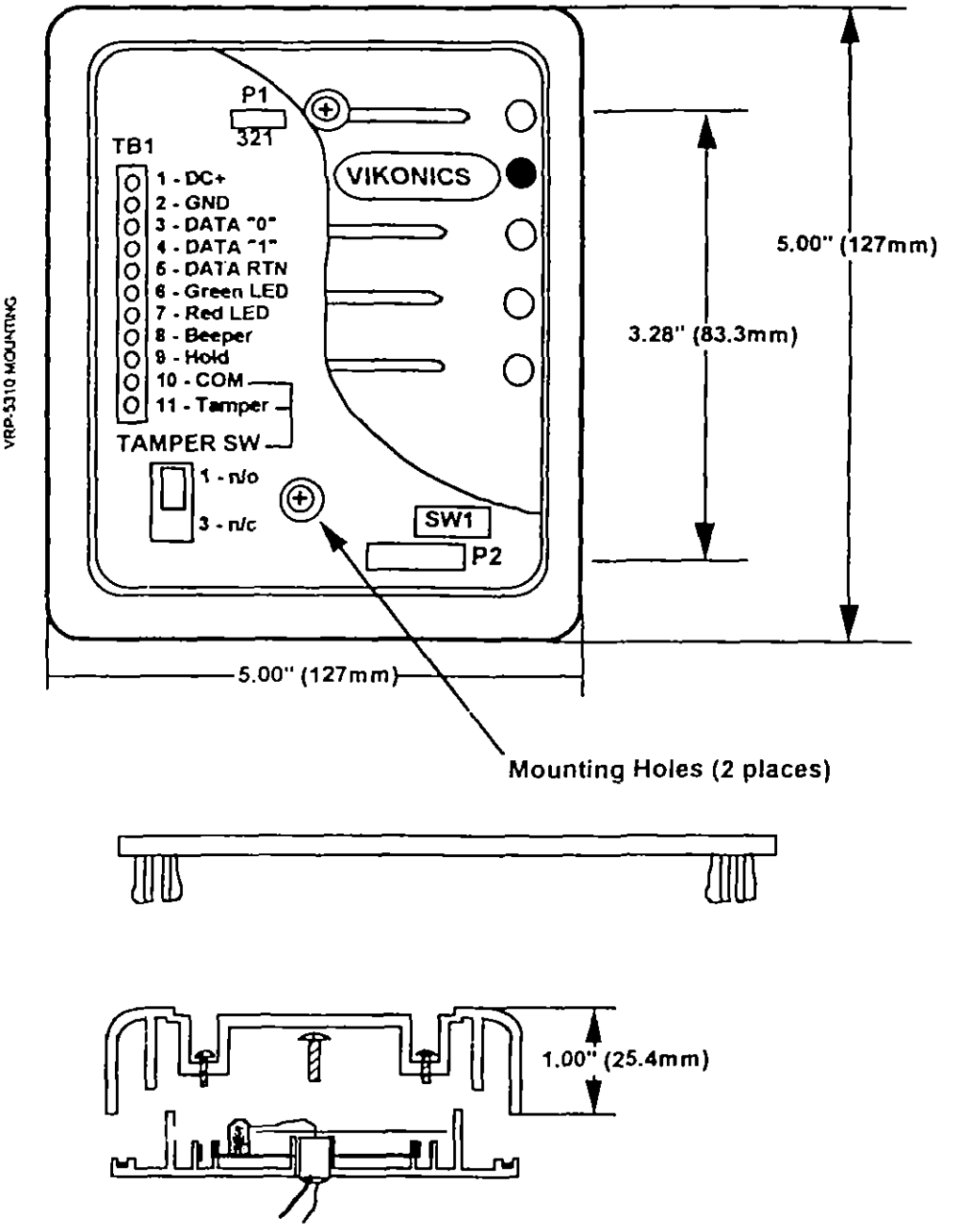


FIGURE 2-10. SCHEMATIC DIAGRAM OF VRP-5310 MOUNTING

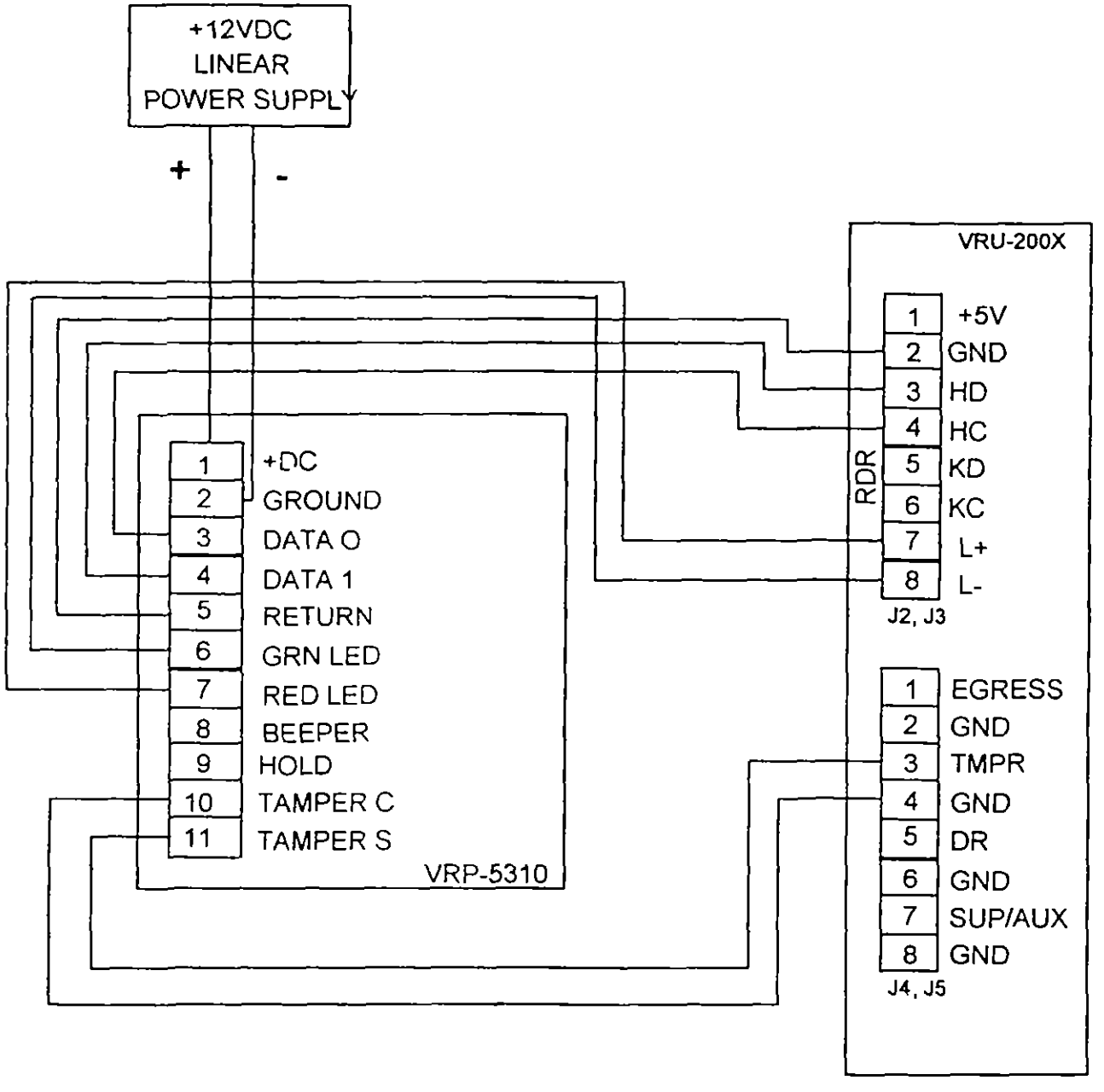


FIGURE 2-11. WIRING DIAGRAM OF VRP-5310

Connect the interface controller communication line to the Multiplexer (or TAC). Normally, a 20 mA current loop interface from connector J7 is used. The required cable consists of two-twisted pairs. Connect the communication cable wires to J7 of the interface controller as shown below:

J7 to	Multiplexer
Pin 1, Tx+	Pin 3, Rx+
Pin 2, Tx–	Pin 4, Rx–
*Pin 3, Rx+	Pin 1, Tx+
*Pin 4, Rx–	Pin 2, Tx–

TABLE 2-6. INTERFACE CONTROLLER CONNECTOR AND PIN FUNCTIONS

CONNECTOR DESIGNATION	PIN NUMBER	FUNCTION
Power – J10	1	+5 Volt D.C. Out
	2	Signal Ground
	3	A.C. In. / +12 VDC. Out
	4	A.C. In / D.C. Ground
	5	V Unregulated
	6	Earth Ground
	7	Signal Ground
	8	V Battery
Alarm / Door J4, J5, J5 (Exp), J6 (Exp)	1	Egress
	2	Signal Ground
	3	Tamper
	4	Signal Ground
	5	Door Contact
	6	Signal Ground
	7	Supervision / Auxiliary
	8	Signal Ground
Door Relays – J1, J4 (Exp)	1	NC
	2	COM
	3	NO
	4	NC
	5	COM
	6	CO
	7	Tamper
	8	Signal Ground
	7 (EXP)	+5V
	8 (EXP)	Signal Ground

TABLE 2-7. KEYPAD READER CONNECTOR AND PIN FUNCTIONS

CONNECTOR DESIGNATION	PIN NUMBER	FUNCTION
J100	1	+5 Vdc
J100	7	Not/Used/Reader Data*
J100	8	Not/Used/Reader Strobe*
J100	2	Keypad Data
J100	3	Keypad Clock
J100	4 together and connect to PIN 4	Ground – Tie Grounds
J100	5	LED+**
J100	6	LED-**

* Not Used by Keypad Jumper to Card Reader

** Jumper to Card Reader if Card Reader LED operation desired (NOT required)

2.2.5.8 Power Supplies

The LVPS-40 power supply provides 12 VDC @ up to eight (8) AMPs for powering Alarm Panels and sensors.

The procedure below assumes that no previous connections to AC power or external devices have been accomplished. Be sure that the AC line circuit breaker is OFF and that the LVPS-40 On/Off switch is OFF.

1. Connect the batteries to the power supply using the wire harness leads as shown. Be sure to connect the **RED wires to the positive (+) terminals** and the **BLACK wires to the NEGATIVE (-)** terminals of the batteries. Note: The Green LEDs (CR3 and CR4) that indicate power is available for the loads should both light.

2. Connect the output lines to the loads. Up to six loads may be connected via terminal blocks TB3 and TB4 with no more than a 4.5 Amp load connected to either terminal block. Terminals 1, 2, and 3 of TB3 and TB4 provide "12 Vdc" (11.5 Vdc) outputs and terminals 4, 5, and 6 provide the common connections.

3. If applicable, connect the Alarm (AC/Power Supply Fail) and Low Battery signals to the corresponding ACP or AMP. Terminal block TB5, terminals 3 and 4 are for the Alarm signal and terminals 5 and 6 are for the Low Battery circuits.

WARNING: BE SURE THAT THE AC LINE CIRCUIT BREAKER IS OFF TO AVOID ELECTRICAL SHOCK.

4. Be sure the LVPS-40 On/Off switch is OFF. Remove the protective panel that covers the AC input terminal block TB1, and then connect the input AC power lines into terminal block TB1. Connect the hot wire to terminal 5; connect the neutral wire to terminal 4. Connect the AC input ground wire to the grounding stud provided on the mounting plate. Replace the protective panel.

CAUTION: Be sure that the batteries are connected per Step 1 above BEFORE applying power and turning on the unit.

5. Turn ON the AC line circuit breaker. Turn ON the LVPS-40 On/Off switch. The red AC power on LED (CR2) and either the red Fast Charge LED (CR17) or green Float LED (CR18) will light. The LVPS-40 is now operational.

2.2.6 Close Circuit Television System (CCTV)

Closed Circuit Television is utilized to assist in detection and assessment of intrusion attempts. It will also provide viewing of elevator areas from the security and watch command areas, for visual assessment before granting access to a person without an access card. The cameras will be viewed on individual monitors at the security office. At the security office the cameras will be multiplexed and recorded on a VCR. A monitor will also be provided to view playback. A monitor at each watch command station will have sequencing views of all the cameras. The following paragraphs provide descriptions of the individual components that comprise the CCTV system.

2.2.6.1 Cameras, Lenses and Housings

The VC2150-24 and V3.5-8VFI-2 lens will be assembled and mounted in the ceiling in the V8606H-XD housing (per the Manufacturer's instructions)

Model V8606H-XD Housing consists of a miniature camera enclosure, constructed of two major parts: a housing, into which the camera and lens combination is bracket-mounted, and a tamperproof hinged cover with a lens viewing

window. The upper steel housing measures 7.0 x 10.5 x 4.4 inches and the lower plastic housing has a very shallow profile, providing an inconspicuous presence in the area under observation. The lower housing is hinged for easy access to the camera and is provided with a tamperproof screw for security.

A duplex outlet is to be installed at each camera location. The CCTV Wiring table is shown below.

TABLE 2-8. CCTV WIRING

From		To			
Device	Location	Device	Location	Wire #	Wire
Camera 1	Hall Barclay	V 210DA Distribution AMP 1	RM 23-18	201	RG-59/U COAX
Camera 2	Hall Barclay	V 210DA Distribution AMP 2	RM 23-18	202	RG-59/U COAX
Camera 3	Hall Freight	V 210DA Distribution AMP 3	RM 23-18	203	RG-59/U COAX
Camera 4	Hall Freight	V 210DA Distribution AMP 4	RM 23-18	204	RG-59/U COAX
Camera 5	Elev. Lobby	V 210DA Distribution AMP 5	RM 23-18	205	RG-59/U COAX
Camera 6	Elev. Lobby	V 210DA Distribution AMP 6	RM 23-18	206	RG-59/U COAX
Video Switcher	RM 23-18	V 210DA Distribution AMP 7	RM 23-50	207	RG-59/U COAX
V 210DA Distribution AMP 7	RM 23-50	Watch Comm. Monitor 1	RM 23-52	208	RG-59/U COAX
V 210DA Distribution AMP 7	RM 23-50	Watch Comm. Monitor 2	RM 23-52	209	RG-59/U COAX
V 210DA Distribution AMP 7	RM 23-50	Watch Comm. Monitor 3	RM 23-52	210	RG-59/U COAX

Notes:
110 VAC duplex Outlet at each camera location

2.2.6.2 Distribution Amplifiers

The V210DA Distribution Amplifier provides a maximum of six video outputs, each equal to the single video input, to be used for operation of other video equipment when looping a single input more than five times. Circuitry with individual and isolated complementary transistor pairs provides power for several 75-ohm loads. The amplifier circuitry is housed in the Phase Eight Module, which is designed for installation in the Phase Eight Card Cage Enclosures.

The VP8RK Card Cage is a durable and compact racking system designed especially to house up to eight, single-position, Phase Eight Modules. The card cage features cooling vents for air circulation and guiding tracks for simple slide-in installation of the Phase Eight modules. Matching snap-on end caps are furnished with the VP8RK to cover card cage mounting hardware.

Each of the card cage will be mounted in the console in Room 23-18.

2.2.6.3 Monitors

The VM5093 Monochrome Closed-Circuit Video Monitors produce high-resolution (1000 lines center), high-contrast pictures on a 9-inch diagonal screen. A power transformer provides circuit isolation from the AC line. The monitor is housed in an enameled steel cabinet and can be single- or double-mounted in a standard 19-inch rack. Front panel controls include brightness, contrast, vertical hold, horizontal hold and AC power on/off.

The VM5093RK and VM5093RK-1 rack mount kits allow for double or single rack mounting, respectively.

Seven monitors will be mounted in the console in Room 23-18. The remaining 3 monitors will be installed in Room 23-52.

2.2.6.4 CCTV Switcher

The switchers in this series are designed to provide flexibility and expandability. Up to seven slaves with a terminated master can be cascaded in one Phase Eight card cage, providing 32 camera inputs. All models feature dual output, allowing the operator to select camera positions for viewing on the "HOLD" monitor while the switching sequence of all cameras continues on the "SCAN" monitor. The switchers have a built-in self-check routine.

The card cages will be mounted in the console in Room 23-18.

2.2.6.5 Video Recorder

The VCR405 time-Lapse Video Cassette Recorder is designed specifically for the needs of CCTV recording. The VCR will be rack mounted (utilizing the VCR401RK rack mount kit) in the console in Room 23-18.

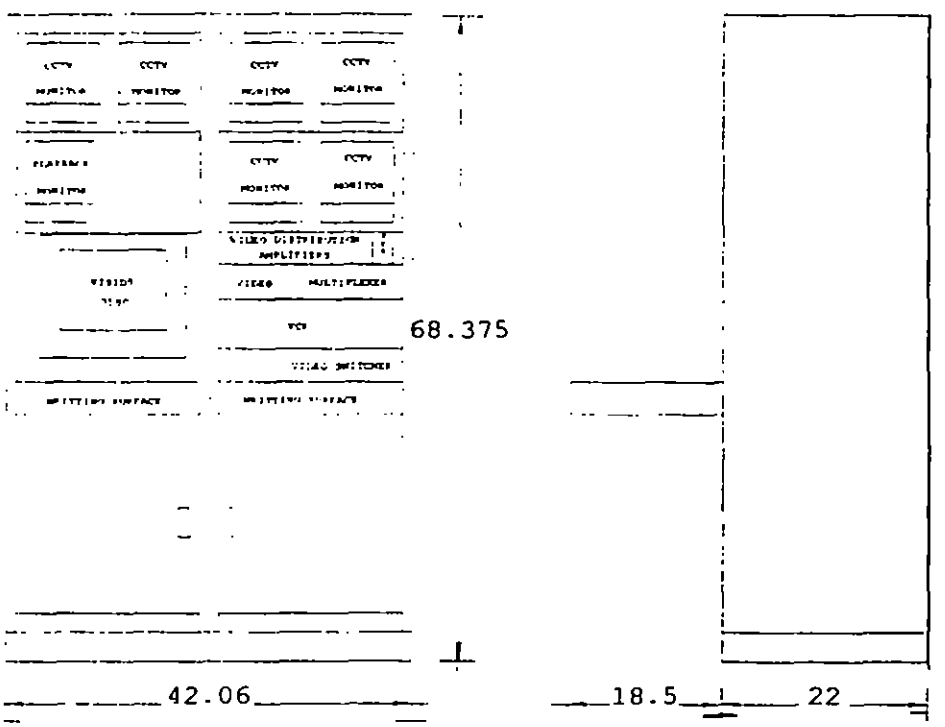
2.2.6.6 Video Multiplexer

The video multiplexer allows multiple cameras to be recorded on one VCR with little loss of information from each camera.

The multiplexer will be mounted in the console in Room 23-18.

2.2.6.7 Security Console

The security console will house the VISIDS 3500 main terminal, CCTV Monitors, Video Multiplexer, Distribution Amplifiers, VCR, and the Video switcher. This will be located in room 23-18. The console configuration is shown in below.



2.3 Specific Materials to be supplied

The following list of equipment is to supplied by Vikonics, Inc. and installed per the Manufacturer's instructions. This list does not include wire, installation materials, etc. which are to be supplied by the Contractor.

TABLE 2-9. ELECTRONIC SECURITY BILL OF MATERIALS

Model	Description	Qty	Manufacturer
VISIDS 3500 (w/ 15" monitor)	Main Security CPU	1	Vikonics
VISIDS 3550 (w/ 15" monitor)	Terminal CPU (workstation)	3	Vikonics
TAC/NCM-B	Front End Processor	Inc.	Vikonics
VP-3570	Network Hub	1	Vikonics
VP-2260	Multiplexer	3	Vikonics
VP-3110	Dot Matrix Printer	2	Vikonics
VRU-2004	Card Reader Interface	5	Vikonics
VP-2508	8 Zone ACS Panel	4	Vikonics
VP-2216	16 Zone Alarm Monitor Panel	1	Vikonics
VP-2232	32 Zone Alarm Monitor Panel	1	Vikonics
LVPS-40	Power Supply	2	Vikonics
VP-1064	Intelligent Keypad	4	Vikonics
VRP-5310	Proximity Reader	14	Vikonics
VRP-5310 + VRI-2130	Proximity Reader w/Keypad	5	Vikonics
V2000-T	Transformer	9	Vikonics
VA-040	Exit Button	8	Vikonics
VA-034	Door Contact	57	Vikonics
VA-04-0470	BMS w/ Resistor	1	Vikonics
VIR-1000	Motion Detector	15	Sentrol
VA-055	End of Line Resistor Network	72	Vikonics
VCP-1365	Access Cards	200	Vikonics
Monarch	Photo Badging System	1	Vikonics
BK240, B401	Smoke Detector & Base	1	System Sensor
US-HUB2A	Duress Switch	1	United Security Prods
VA-FA416	Duress Receiver	3	Inovonics
VA-FA204	Portable Duress Alarm	3	Inovonics
VA-VIB	Vibration Sensor	1	Potter Electric
	Console	1	Vikonics
	Duct Alarms		Vikonics

* +10%, -15% @ 60 Hz.

The following list equipment is to supplied by Vikonics, Inc. and installed per the Manufacturer's instructions. This list does not include wire, connectors, installation materials, etc. which are to be supplied by the Contractor.

TABLE 2-10. CCTV BILL OF MATERIALS

Model	Description	Qty	Manufacturer
VC2150-24	B/W Camera	6	Vicon Industries
VC24PS-1	Power Supply (for VC2150-24 Camera)	6	Vicon Industries
V3.5-8VFI-2	Lens	6	Vicon Industries
V8606H-XD	Indoor Ceiling Housing	6	Vicon Industries
V8606HXD-ACP	Adjustable Ceiling Panel	6	Vicon Industries
VCR405	VCR	1	Vicon Industries
VCR401RK	Rack Mount Kit	1	Vicon Industries
VP8RK	Rack	2	Vicon Industries
V1504AT-M	Switcher (Master)	1	Vicon Industries
V1504AL-S	Switcher (Slave)	1	Vicon Industries
V210DA	Distribution Amplifier	7	Vicon Industries
VM5093	Monitor	10	Vicon Industries
VM5093-RK	Rack Mount Kit for Monitor (dual)	3	Vicon Industries
VM5093RK-1	Rack Mount Kit for Monitor (single)	1	Vicon Industries
V816SB-EC	Video Mux	1	Vicon Industries

The items listed in Tables 2-9 and 2-10 will be purchased from:

Vikonics, Inc.
370 North Street
Teterboro, NJ 07608

Phone: 201-641-8077
Fax: 201-641-7728

The cost for these materials is $90,000.00. This price includes Technical Support, Calibration, System Certification, Database Entry and two days of training; these tasks will be performed by Vikonics personnel.

3.0 Electronic Security Tasks

3.1 Electronic Security Wiring Requirements

All wiring is to conform to applicable building codes. All wires are to be permanently marked with the wire numbers shown on the wire lists.

3.2 CCTV Mounting and wiring

The contractor is responsible for installation and test of all CCTV equipment. This includes, but is not limited to, testing video output and monitor input

TABLE 3-1. CCTV WIRING

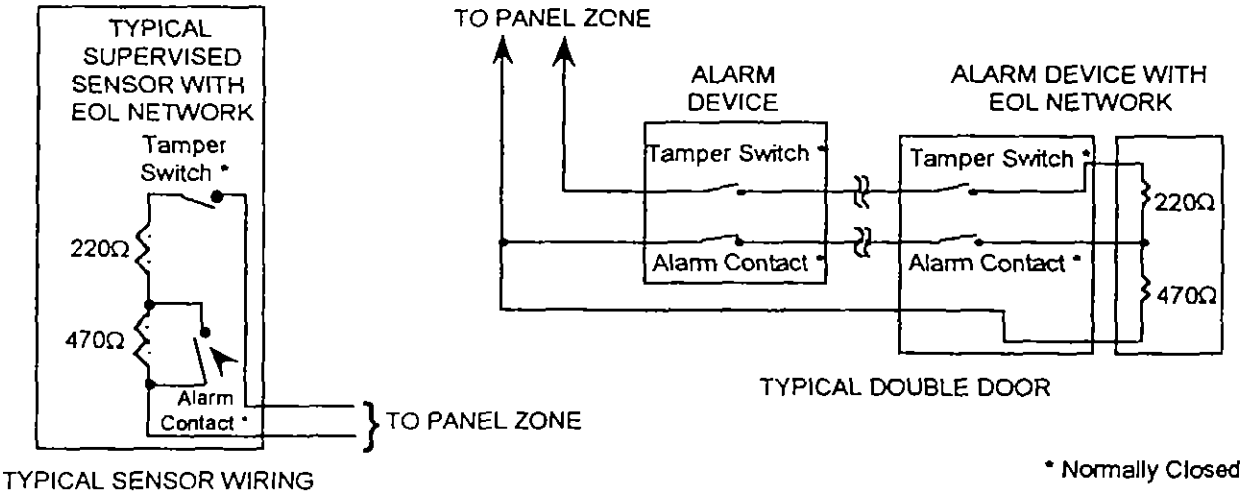
From		To			
Device	Location	Device	Location	Wire #	Wire
Camera 1	Hall Barclay	V 210DA Distribution Amp 1	RM 23-18	201	RG-59/U COAX
Camera 2	Hall Barclay	V 210DA Distribution Amp 2	RM 23-18	202	RG-59/U COAX
Camera 3	Hall Freight	V 210DA Distribution Amp 3	RM 23-18	203	RG-59/U COAX
Camera 4	Hall Freight	V 210DA Distribution Amp 4	RM 23-18	204	RG-59/U COAX
Camera 5	Elev. Lobby	V 210DA Distribution Amp 5	RM 23-18	205	RG-59/U COAX
Camera 6	Elev. Lobby	V 210DA Distribution Amp 6	RM 23-18	206	RG-59/U COAX
Video Switcher	RM 23-18	V 210DA Distribution Amp 7	RM 23-50	207	RG-59/U COAX
V 210DA Distribution Amp 7	RM 23-50	Watch Comm. Monitor 1	RM 23-52	208	RG-59/U COAX
V 210DA Distribution Amp 7	RM 23-50	Watch Comm. Monitor 2	RM 23-52	209	RG-59/U COAX
V 210DA Distribution Amp 7	RM 23-50	Watch Comm. Monitor 3	RM 23-52	210	RG-59/U COAX

Notes:
110 VAC duplex Outlet at each camera location

3.3 Sensor Mounting and Wiring Requirements

Each type of sensor to be provided and installed is identified in this section. End of line resistors with each sensor or string of sensors. The EOL resistor network is to be wired as shown below.

FIGURE 3-1. END OF LINE RESISTOR WIRING



3.3.1 Balanced Magnetic Door Contacts

Balanced magnetic switch (BMS) door contacts will be installed on the doors shown on the drawings. The BMS consists of a magnet that is mounted to the door leaf and a magnetic switch that is mounted to the doorframe. Neither the switch nor the magnet shall be accessible from the unsecure side of the door. The BMS is to be mounted at the top of the door and frame at the edge opposite the hinges. The wires from the BMS are to be extended in conduit to a junction box located above the door and in the area between the dropped ceiling and the next floor deck. The junction box is to be within the secure area. The contractor shall verify that the BMS changes from a normally closed state (with the door closed) to an open state, when the door has been opened 2" or less. This is measured from the doorframe to the edge opposite the hinges. Wiring information is shown in section 3.5.

3.3.2 Motion Detectors

Sentrol Model 6157 motion detectors are to be installed, per the manufacturer's instructions, in the locations indicated on Drawing 038L002 and wired per Table 3-3. The sensors detection pattern is to be concentrated in the direction of normal room entry. Install EOLs per Figure 3-1. After mounting and installation of wiring, apply DC power and perform a walk test to verify proper operation. Using an ohm meter, verify resistance change of 470Ω at panel end of sensor wiring. Connect wires to proper zone on alarm panel (see Riser Diagram 038Z001 and the paragraphs on Alarm Zone Connections in Section 2).

3.3.3 Smoke Detectors

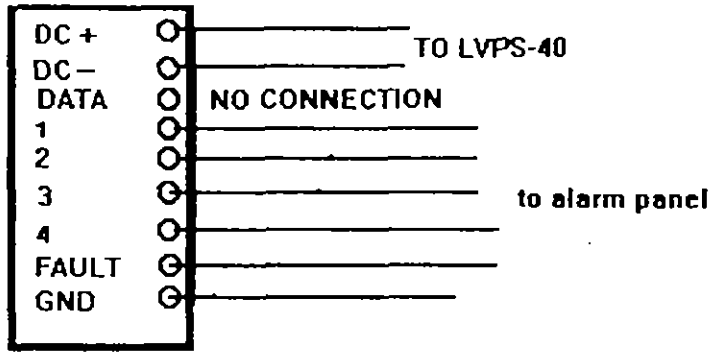
A System Sensor Model BK2400 smoke detector and Model B401 base are to be installed and mounted in the center of Room 23-16 per the manufacturer's instructions. Install EOLs per Figure 3-1. After mounting and installation of wiring, apply DC power and perform a walk test to verify proper operation. Using an ohm meter, verify resistance change of 470Ω at panel end of sensor wiring. Connect wires to proper zone on alarm panel (see Riser Diagram 038Z001 and the paragraphs on Alarm Zone Connections in Section 2).

3.3.4 Duress Switch

A United Security Products Model HUB2A duress switch is to be installed at the Receptionist's desk. Install EOLs per Figure 3-1. After mounting and installation of wiring, apply DC power and perform a walk test to verify proper operation. Using an ohm meter, verify resistance change of 470Ω at panel end of sensor wiring. Connect wires to proper zone on alarm panel (see Riser Diagram 038Z001 and the paragraphs on Alarm Zone Connections in Section 2).

3.3.5 Duress Receiver

Three Inovonics Model FA416 duress receivers are to be installed in Rooms 23-07, 23-13, and 23-53 in the locations indicated on Drawing A-23-3. Wires are to be run back to the Alarm Panel per Table 3-3 and terminated in conjunction with Riser Diagram 038Z001 and the paragraphs on Alarm Zone Connections in Section 2. One pair of wires will supply 12 VDC from the LVPS-40 to the receivers. Two pair of wires will connect to the four (4) outputs from the receivers. The remaining pair will be connected to the fault and ground terminal on the receiver. Continuity is to be tested on all wiring. Vikonics will program the units.



3.3.6 Portable Duress Alarm

Three Inovonics Model FA204 portable duress alarms will be supplied. No installation is required. Programming will be done by Vikonics.

3.3.7 Duct Alarms

3/8" wooden dowels are to be installed in AC ducts as indicated on Drawing 038L005. The dowels are installed by drilling holes through opposite sides of the duct. The hole size should accommodate a rubber grommet with an I.D. of 3/8. The wooden dowel is placed through the holes with the embedded wire sticking out of both ends. Multiple dowels are connected in series (using wire nuts) with the two output wires wired to the EOL as shown in Figure 3-1 ("wire" replaces "alarm contact".) The wiring back to the panels is shown in Table 3-3. When the wiring is completed, test for 470Ω resistance change at the panel end of the wiring when one of the wire nut connections is opened versus closed.

3.3.8 Vibration Sensors

A vibration sensor (manufacturer – Potter Electric Signal Model EVD-S) is to be installed in Room 23-16. A total of four EVD-P pickup units will be supplied for installation on each of the four walls in Room 23-16. These pickup units must be mounted directly to the steel plates prior to concealment. The EVD-P sensors are wired back to the EVD-S per manufacturer's instructions. EOLs are installed on alarm relay connectors of the EVD-S per Figure 3-1. Using an ohm meter, verify resistance change of 470Ω at panel end of sensor wiring.

3.5 Card Reader and Alarm Wiring Requirements

The wiring required between the hardware at a security door and either the alarm panel or card reader interface is shown in the following table.

TABLE 3-2. CARD READER AND ALARM WIRING REQUIREMENTS

DOOR NO.	DOOR LOCATION	Door Type	Wire Req.	wire #	To Panel	Panel Location	door Model
01A	EMPLOYEE ENTRANCE	A	6 PR 22 AWG SHIELDED	10	CRI B	RM 23-50	Insulguard HM544 series
			2PR 18AWG SHIELDED	11			Keypad & Reader
01B	MAIN ENTRANCE	A	6 PR 22 AWG SHIELDED	12	CRI B	RM 23-50	Insulguard ICDS series
			2PR 18AWG SHIELDED	13			
02A	EOC LEFT	A	6 PR 22 AWG SHIELDED	1	CRI A	RM 23-50	
			2PR 18AWG SHIELDED	2			
02B	EOC RIGHT	A	6 PR 22 AWG SHIELDED	40	CRI E	RM 23- 18	Keypad & Reader
			2PR 18AWG SHIELDED	41			
03	MAYOR'S SUITE A/V RM	B	1 PR 18 AWG SHIELDED	321	AMP31-1	RM 23-18	Keypad & Reader
04	MAIN CONF. ROOM	A	6 PR 22 AWG SHIELDED	20	CRI C	RM 23- 18	Gaffco G203 series
			2PR 18AWG SHIELDED	21			
05	MAYOR'S SUITE	D	6 PR 22 AWG SHIELDED	30	CRI D	RM 23- 18	Insulguard ICDS series
			2PR 18AWG SHIELDED	31			
09	1ST DEP. DIRECTOR	A	6 PR 22 AWG SHIELDED	32	CRI D	RM 23- 18	
			2PR 18AWG SHIELDED	33			
10	INSIDE CONF. ROOM	A	6 PR 22 AWG SHIELDED	42	CRI E	RM 23- 18	Overly tempest series 60
			2PR 18AWG SHIELDED	43			Keypad & Reader
13	EXECUTIVE SUITE MAIN	D	6PR 22 AWG SHIELDED	34	CRI D	RM 23-18	Gaffco G203 Series
			2PR 18AWG SHIELDED	35			
15	COMMISSIONER'S SUITE	A	6 PR 22 AWG SHIELDED	36	CRI D	RM 23-18	Gaffco G203 Series
			2PR 18AWG SHIELDED	37			Keypad & Reader
16	VAULT DOOR	C	1 PR 18 AWG SHIELDED	341	ACS 34-1	RM 23-16	Overly Class 5 vault door
17	LIFRIERI'S OFFICE	A	6 PR 22 AWG SHIELDED	44	CRI E	RM 23- 18	Keypad & Reader
			2PR 18AWG SHIELDED	45			
18	SECURITY RM 23-18	B	1 PR 18 AWG SHIELDED	327	AMP 31-7	RM 23- 18	
20	CENTRAL FILES DOOR	B	1 PR 18 AWG SHIELDED	317	AMP 30-7	RM 23- 18	
21C	UPPER RIGHT HALL	E	6 PR 22 AWG SHIELDED	22	CRI C	RM 23- 18	
			2PR 18AWG SHIELDED	23			
23	LAN ROOM DOOR	A	6 PR 22 AWG SHIELDED	46	CRI-E	RM 23- 18	
			2PR 18AWG SHIELDED	47			
24	STORAGE AREA	B	1 PR 18 AWG SHIELDED	257	AMP 9-7	RM 23-50	

35	GIS COORD OFFICE DR	B	1 PR 18 AWG SHIELDED	315	AMP 30-5	RM 23-18	
40A	INNER RECEPTION	E	6 PR 22 AWG SHIELDED	24	CRI C	RM 23- 18	No reader control only
			2PR 18AWG SHIELDED	25			
40B	INNER RECEPTION	E	6 PR 22 AWG SHIELDED	26	CRI C	RM 23- 18	
			2PR 18AWG SHIELDED	27			
43	HVAC ROOM	G	1 PR 18 AWG SHIELDED	252	AMP 9-2	RM 23-50	
44A	LOWER RIGHT HALL	A	6 PR 22 AWG SHIELDED	16	CRI B	RM 23-50	
			2PR 18AWG SHIELDED	17			
48B	CONF HALL UPPER	A	6 PR 22 AWG SHIELDED	3	CRI A	RM 23-50	
			2PR 18AWG SHIELDED	4			
52	WATCH COMMAND	A	6 PR 22 AWG SHIELDED	5	CRI A	RM 23-50	
			2PR 18AWG SHIELDED	6			
54A	FRT ELEVATOR UPPER	F	6 PR 22 AWG SHIELDED	7	CRI A	RM 23-50	
			2PR 18AWG SHIELDED	8			
54B	FRT ELEV. LOBBY LOWER	F	6 PR 22 AWG SHIELDED	14	CRI B	RM 23-50	
			2PR 18AWG SHIELDED	15			
55	CENTER STORAGE	B	1 PR 18 AWG SHIELDED	301	AMP 29-1	RM 23- 18	
57	COMM CLOSET B	G	1 PR 18 AWG SHIELDED	253	AMP 9-3	RM 23-50	
58	ELEC CLOSET B	B	1 PR 18 AWG SHIELDED	254	AMP 9-4	RM 23-50	
61	STAIR #2	B	1 PR 18 AWG SHIELDED	302	AMP 29-2	RM 23- 18	
62	TELCO CLOSET C	G	1 PR 18 AWG SHIELDED	303	AMP 29-3	RM 23- 18	
63	COMM CLOSET C	G	1 PR 18 AWG SHIELDED	304	AMP 29-4	RM 23- 18	
64	ELECTRICAL CLOSET C	B	1 PR 18 AWG SHIELDED	305	AMP 29-5	RM 23- 18	
67	COMM. ROOM D	G	1 PR 18 AWG SHIELDED	311	AMP 30-1	RM 23- 18	
68	FAN ROOM	G	1 PR 18 AWG SHIELDED	312	AMP 30-2	RM 23- 18	
69	ELECTRICAL CLOSET D	G	1 PR 18 AWG SHIELDED	308	AMP 29-8	RM 23- 18	
70	TELCO CLOSET D	G	1 PR 18 AWG SHIELDED	307	AMP 29-7	RM 23- 18	
71	ELEV. MACHINE ROOM	B	1 PR 18 AWG SHIELDED	306	AMP 29-6	RM 23- 18	
73	COMM. CLOSET A	G	1 PR 18 AWG SHIELDED	256	AMP 9-6	RM 23-50	
74	ELEC CLOSET A	B	1 PR 18 AWG SHIELDED	255	AMP 9-5	RM 23-50	
75	TELCO CLOSET A	G	1 PR 18 AWG SHIELDED	262	AMP 10-2	RM 23-50	
76	TELCO CLOSET B	B	1 PR 18 AWG SHIELDED	261	AMP 10-1	RM 23-50	
	STAIR #1	B	1 PR 18 AWG SHIELDED	251	AMP 9-1	RM 23-50	
	RISER ROOM DOOR		1 PR 18 AWG SHIELDED	355	ACS 50-5	Radio Room	
	FUEL TANK HATCH		1 PR 18 AWG SHIELDED	361	ACS 52-1	RM 7-XX	
	RADIO ROOM DOOR	B	1 PR 18 AWG SHIELDED	351	ACS 50-1	Radio Room	
	GENERATOR ROOM	G	1 PR 18 AWG SHIELDED	362	ACS 52-2	RM 7-XX	
	WATER STORAGE RM	G	1 PR 18 AWG SHIELDED	363	ACS 52-3	RM 7-XX	

Sensor Wire Requirements

TABLE 3-3. SENSOR WIRING REQUIREMENTS

Room	Sensor location	Wire Req.	Wire #	To Panel	Panel Location
23-05	MAYOR'S SUITE MOTION	2 PR 18 AWG SHIELDED	322	AMP 31-2	RM 23- 18
23-07	DURESS RECEIVER #1	2 PR 18 AWG SHIELDED	331	AMP 32-1	RM 23- 18
23-07	DURESS RECEIVER #1	2 PR 18 AWG SHIELDED	332	AMP 32-1	RM 23- 18
23-09	IST DEP. DIRECTOR MOTION	2 PR 18 AWG SHIELDED	323	AMP 31-3	RM 23- 18
23-11	COMMISH VEST. MOTION	2 PR 18 AWG SHIELDED	324	AMP 31-4	RM 23- 18
23-13	DURESS RECEIVER #2	2 PR 18 AWG SHIELDED	333	AMP 32-2	RM 23- 18
23-13	DURESS RECEIVER #2	2 PR 18 AWG SHIELDED	334	AMP 32-2	RM 23- 18
23-15	COMMISH OFFICE MOTION	2 PR 18 AWG SHIELDED	325	AMP 31-5	RM 23- 18
23-16	VAULT PIR	2 PR 18 AWG SHIELDED	342	ACS 34 -2	RM 26-16
23-16	VIBRATION SENSOR	2 PR 18 AWG SHIELDED	343	ACS 34 -3	RM 23-16
23-16	SMOKE DETECTOR	2 PR 18 AWG SHIELDED	344	ACS 34 -4	RM 23-16
23-17	LIFRIERI'S OFFICE MOTION	2 PR 18 AWG SHIELDED	326	AMP 31-6	RM 23- 18
23-18	SECURITY MOTION	2 PR 18 AWG SHIELDED	328	AMP 31-8	RM 23- 18
23-20	CENTRAL FILES MOTION	2 PR 18 AWG SHIELDED	318	AMP 30-8	RM 23- 18
23-23	LAN ROOM MOTION	2 PR 18 AWG SHIELDED	314	AMP 30-4	RM 23- 18
23-35	GIS COORD OFFICE MOTION	2 PR 18 AWG SHIELDED	316	AMP 30-6	RM 23- 18
23-53	DURESS RECEIVER #3	2 PR 18 AWG SHIELDED	335	AMP 32-3	RM 23- 18
23-53	DURESS RECEIVER #3	2 PR 18 AWG SHIELDED	336	AMP 32-3	RM 23- 18
	FIRE PANEL	1 PR 18 AWG SHIELDED	258	AMP 9-8	RM 23-50
	MOTION #1 Radio Room	2 PR 18 AWG SHIELDED	352	ACS 50-2	Radio Room
	MOTION #2 Radio Room	2 PR 18 AWG SHIELDED	353	ACS 50-3	Radio Room
	AC UNIT Radio Room	1 PR 18 AWG SHIELDED	354	ACS 50-4	Radio Room
	MOTION WATER STORAGE	2 PR 18 AWG SHIELDED	364	ACS 52-4	RM 7-XX
23-40	Reception duress	1 PR 18 AWG SHIELDED	263	AMP 10-3	RM 23-50
23-10	CONFERENCE ROOM	1 PR 18 AWG SHIELDED	334	AMP 32-4	RM 23-18

SMW Project 5149

NEW YORK CITY OFFICE OF EMERGENCY MANAGEMENT
EMERGENCY OPERATIONS CENTER

Section 16700A
Copper Telecommunications Cable Plant Specifications

Prepared for:
Swanke Hayden Connell Architects
New York, New York

April 6, 1998

TABLE OF CONTENTS

PART 1 - INTRODUCTION AND PROJECT BRIEF 2
Section 16700 Document Summary 2
Section 16700A 2
Section 16700B 2
Section 16700C 2
New York City Department of Information Technology and Telecommunications (DoITT) Scope of Work Summary 2
Notes: 3

SECTION 16700A
COPPER TELECOMMUNICATIONS CABLE PLANT SPECIFICATIONS

PART 1 - INTRODUCTION AND PROJECT BRIEF

The New York City Office of Emergency Management (OEM) which operates under the authority of the Office of the Mayor of the City of New York is in the process of creating an Emergency Operations Center (EOC) at 7 World Trade Center. The architectural firm of Swanke Hayden Connell of New York City has engaged the consulting firm of Shen Milsom and Wilke of New York City as a specialty consultant in the area of technology infrastructure design. This infrastructure will utilize a mixture of copper and fiber optic cables to transport voice, data, video and multimedia services throughout the facility.

Section 16700 Document Summary

1. Section 16700A (this document) describes the New York City Department of Information Technology and Telecommunications (DoITT) Scope of Work.

2. Section 16700B describes the installation of the facility's copper and fiber optic backbone cabling for services not covered in Section 16700A.

3. Section 16700C describes the installation of the facility's data, cable TV service and other miscellaneous systems infrastructure not described elsewhere.

New York City Department of Information Technology and Telecommunications (DoITT) Scope of Work Summary

DoITT's Scope of Work for this project shall include, but is not limited to:

(1) obtaining and provisioning telecommunications services from service providers (e.g. Bell Atlantic, WinStar and Teleport Communications Group) as required to support the requirements of the EOC;

(2) the oversight, coordination and supervision of the installation of the required telecommunications services including cabling and equipment racks;

(3) the testing and final acceptance of the required telecommunications services;

(4) the installation of Unshielded Twisted-Pair (UTP) telecommunications cables to each Work Area Outlet (WAO) as designated on the telecommunications documents; and

(5) the installation of cable management hardware on backboards and in equipment racks in sufficient quantities and of the proper type to ensure an orderly and neat cable installation.

Notes:

1. *The term "installation" includes the materials and labor required to physically install, terminate, test and label the designated cable. After installation the system shall be fully functional and ready to use for its intended purpose.*

2. Cable tray and conduit sleeves, when shown on the telecommunications drawings, are for reference only. These items will be provided by others under a separate contract.

SMW Project 5149

NEW YORK CITY OFFICE OF EMERGENCY MANAGEMENT
EMERGENCY OPERATIONS CENTER

Section 16700B
Copper and Fiber Optic Telecommunications Backbone Cable Plant Specifications

Prepared for:
Swanke Hayden Connell Architects
New York, New York

April 6, 1998

TABLE OF CONTENTS

PART 1 - INTRODUCTION AND PROJECT BRIEF 4
- Section 16700 Documents 4
- Section 16700A 4
- Section 16700B 4
- Section 16700C 4
- Scope of Work Summary 4
- Notes 5

PART 2 - GENERAL TERMS AND CONDITIONS 5

PART 3 - SPECIAL CONDITIONS 7

PART 4 - TESTING 8

PART 5 - WORK NOT INCLUDED 8

PART 6 - REFERENCE DRAWINGS 8

PART 7 - DEFINITIONS 9

PART 8 - SUBMITTALS 10

PART 9 - QUALITY ASSURANCE 11

PART 10 - DELIVERY, STORAGE AND HANDLING 12

PART 11 - WARRANTY/EXTENDED WARRANTY PROGRAM 13

PART 12 - PRODUCTS 13

PART 13 - PART NUMBERS 14
- Fiber Optic Cables 14
- Fiber Optic Patch Cords and Connectors 16
- Multi-Mode Fiber Optic Patch Cords 16
- Single-Mode Fiber Optic Patch Cords 16
- Fiber Optic Cable Connectors 16
- Wire Management 17
- Backboard Wire Management Hardware, D-Rings 17
- Suspended Cable Wire Management Hardware, Type 1 17
- Suspended Cable Wire Management Hardware, Type 2 17
- Cable Management Straps 18
- Labels 19
- Fire Stopping Materials 20

PART 14 - EXECUTION 21

PART 15 - FIELD QUALITY CONTROL 23

SECTION 16700B
COPPER AND FIBER OPTIC TELECOMMUNICATIONS BACKBONE CABLE PLANT SPECIFICATIONS

PART 1 - INTRODUCTION AND PROJECT BRIEF

The New York City Office of Emergency Management (OEM) which operates under the authority of the Office of the Mayor of the City of New York is in the process of creating an Emergency Operations Center (EOC) at 7 World Trade Center. The architectural firm of Swanke Hayden Connell of New York City has engaged the consulting firm of Shen Milsom and Wilke of New York City as a specialty consultant in the area of technology infrastructure design. This infrastructure will utilize a mixture of copper and fiber optic cables to transport voice, data, video and multimedia services throughout the facility.

Section 16700 Documents

1. Section 16700A describes the New York City Department of Information Technology and Telecommunications (DoITT) Scope of Work.

2. Section 16700B (this document) describes the installation of copper and fiber optic backbone cabling for services not covered in Section 16700A.

3. Section 16700C describes the installation of the facility's data, cable TV service and other miscellaneous systems infrastructure not described elsewhere.

Scope of Work Summary

(1) the installation, termination, testing and commissioning of vertical and horizontal backbone fiber optic cables in the following locations:

On the twenty-third (23rd) floor:

a. One (1) twenty-four strand (24-strand) multimode fiber optic cable and one (1) six-strand (6-strand) single-mode fiber optic cable between the LAN/Head-End room on the east side of the building and the auxiliary LAN equipment room on the west side of the building (immediately south of the Motorola radio equipment room).

Between the twenty-third (23rd) floor and the first (1st) floor electric closet "D":

b. One (1) twenty-four stand (24-strand) multimode fiber optic cable between the area under the press corp riser in the Press Room to electric closet "D" on the first

(1st) floor of the building (located in the south-east corner of the building). The routing will from the Press Room to Telecom Closet "A" on the 23rd floor. The cable will then proceed vertically down to the 7th floor where it will transition horizontally to electric closet "D." The cable will then proceed vertically down to the 1st floor where it will terminate in a wall-mounted equipment rack provided by others.

(2) the installation of fiber optic termination trays as designated;

(3) the installation, termination, testing and commissioning of backbone copper horizontal cables in the following locations:

On the twenty-third (23rd) floor:

a. Two (2) twenty-five pair (25-pair) Cat. 5, UTP binder cables from the LAN/Head-End Room on the east side of the building to the Auxiliary LAN Equipment Room in the west side of the building.

b. One (1) twenty-five pair (25-pair) Cat. 5, UTP binder cable from the LAN/Head-End Room to the Mayor's suite AV room (ISDN circuits for video teleconferencing, etc.).

c. Four (4) twenty-five pair (25-pair) Cat. 5, UTP binder cables from the LAN/Head-End Room to the Mayor's Suite Security Room (data network connectivity);

d. One (1) one-hundred pair (100-pair) Cat. 3, UTP binder cable from the LAN Head-End Room to the Motorola equipment room on the west side of the building.

(4) the installation of cable management hardware on backboards and in equipment racks in sufficient quantities and of the proper type to ensure an orderly and neat cable installation.

Notes:

1. *The term "installation" includes the materials and labor required to physically install, terminate, test and label the designated cable. After installation the system shall be fully functional and ready to use for its intended purpose.*

2. Cable tray and conduit sleeves, when shown on the telecommunications drawings, are for reference only. These items will be provided by others under a separate contract.

PART 2 - GENERAL TERMS AND CONDITIONS

The following shall apply to all work under this Contract:

A. The Contractor shall comply with all applicable federal, state and local regulations and statues.

B. *The specifications in this document explain the basic scope of work to be performed and the basic duties of the Contractor. This document is not intended to be used as a complete Design Manual or Bill of Materials for all materials required under this Contract.*

C. The Contractor shall not sub-contract any portion of the work required under this contract without the express written permission of the Architect. Only full-time, permanent employees of the Contractor shall be used on this project.

D. The Contractor shall, based on prior experience with projects of similar size and scope, bring to the attention of the Architect and Shen Milsom & Wilke, in writing, any items not listed in this specification that are required to achieve the intent of this document.

E. The work to be performed under this contract may require that existing voice or data services be interrupted for equipment installation or testing. Therefore, the Contractor must work in close cooperation with the project team to coordinate and schedule the work to be done. The Contractor should expect that some of the work required under this contract will be done after normal business hours, on holidays and on weekends depending on the project schedule or to minimize service disruptions.

F. The Contractor will be required to meet with selected project personnel one week before the start of the work described in this document to review any required changes to the requirements of this document. If, as a result of this meeting, there is a modification of the Contractor's price, the changes shall be submitted in writing to designated project personnel for approval. Written approval from the Architect for cost adjustments is required before any work may begin unless otherwise documented in writing.

G. Every attempt will be made to provide complete written documentation for the work to be done under this contract, but the Contractor must be prepared to work from verbal directions from designated project personnel. Such verbal communication shall be documented, in writing, without delay and circulated to all parties.

H. It is the Contractor's responsibility to coordinate and provide for the movement of equipment, delivery of materials, access to the job site, establishing a site office and other ancillary activities.

PART 3 - SPECIAL CONDITIONS

A. Applicable engineering standards, specifications, drawings and codes referred to in this document shall be considered part of the contract specifications.

B. The Contractor is responsible for, and shall pay for, any and all permits and licenses required under this contract. The Contractor shall request, obtain, and schedule any and all required inspections or other regulatory coordination services as may be required. If required, the Contractor shall coordinate his activities with service providers to obtain the services required under this contract. The Contractor shall include in his price all costs to be incurred relative to the furnishing and installation of the system described herein.

C. *It is the intent of these specifications to provide a complete cable plant, ready for use. Any items not specifically shown on the drawings or called for in the specifications, but normally required to conform with the intent of this contract are to be considered as part of the Contract.*

D. To provide an engineered level of performance only products from one manufacturer shall be supplied for each functional item[1] as approved by the Architect or the Architect's designated representative. Multiple manufacturers of an item will not be permitted, unless specifically approved in writing by the Architect or the Architect's designated representative.

E. This document describes equipment and performance specifications. Installation details shall be as indicated on the Telecommunications Drawings. Any discrepancies found between the Specification and the Drawings shall be immediately brought to the attention of the Architect or the Architect's designated representative.

F. *Should terminology, including, but not limited to, "shall"; "provide"; "install;" "complete;" "furnish" fail to be included explicitly in the text of this document, they shall apply implicitly to ensure that a fully-functional cabling system is provided.*

[1] For example: UTP cable, fiber optic cable, termination blocks, etc.

PART 4 - TESTING

A. *The Scope of Work covered by this Contract includes the items described in Section 1 of this document including all labor necessary to perform and complete such construction, all materials and equipment required and all services, facilities, tools, equipment necessary to perform and complete such construction;*

B. The testing of the cables installed under this contract shall be done in accordance with industry standard practices. In all cases the testing criteria shall be normalized to the physical installation (e.g. a specification for attenuation per 1,000 feet shall be normalized to the actual installed cable length).

1. The contractor shall provide the make, model and serial number of the test equipment to be used as well as proof of calibration.

2. The results of Cat. 5, UTP basic link testing may be reported as Pass/Fail.

3. The testing criteria for enhanced performance UTP cable basic link testing will be defined by the Owner, SM&W and the contractor at the time of contract award. At a minimum, enhanced performance cable shall pass Cat. 5, UTP testing standards.

4. Fiber optic cable shall be tested in accordance with EIA/TIA 526-14 *Optical Power Loss Measurement of Installed Multi-mode Fiber Cable Plant* and EIA/TIA 526-7 *Optical Power Loss Measurement of Installed Single-mode Fiber Cable Plant.*

5. Multi-mode fiber optic cable shall be tested for attenuation loss at 850 nm and 1300 nm. Single-mode fiber optic cable shall be tested for attenuation loss at either 1310 nm or 1550 nm.

6. The contractor shall maintain a log documenting the name of the installer performing the test; the date and time of the test; and the make, model and serial number of the testing device used. It is also recommended, but not required, that the contractor keep an audit trail documenting the lot from which each cable run was installed (e.g. PO number, manufacturer's date and lot code, etc.).

PART 5 - WORK NOT INCLUDED

A. Cable tray installation.
B. Conduit sleeves.
C. Commercial AC power wiring and outlets.

D. Telecommunications grounding system.

PART 6 - REFERENCE DRAWINGS

TC-100 General Notes and Symbols
TC-101 Telecommunications Backbone Pathways Schematic
TC-102 Telecommunications Backbone Cabling Schematic
TC-103 Telecommunications Work Outlet Locations

The Contractor is specifically directed to review, and become familiar with, the Architectural ("A") and Electrical ("E") drawings to understand the full details of the project.

PART 7 - DEFINITIONS

A. "PROVIDE" or "FURNISH" means to supply, purchase, transport, place, erect, connect, test and turn over to the user, complete and ready for normal commercial operation, the cabling systems referred to in this document.

B. "SUPPLY" means to purchase, procure, acquire, and deliver the required goods and services to the locations as designed.

C. "INSTALL" means to move from property line, set in place, join, unite, fasten, link, attach, set up or otherwise connect together equipment supplied under this contract. Installation shall be considered complete when the equipment or system is ready for normal commercial operation.

D. "WIRE, WIRING" means the inclusion of all cables, fittings, conductors, connectors, connector strips, connections, terminations and cable management devices, etc. required in connection with this work.

E. "AS DIRECTED" means as directed by the Architect or his representative.

F. "CONCEALED" means embedded in masonry or other construction methods such that physical damage must to done to access the cabling or device once construction is completed.

G. "ACCESSIBLE" means an item embedded in the building construction, but for which an access method has been provided.

H. "READILY ACCESSIBLE" mean an item that may be accessed or operated without the use of special tools or equipment (e.g. ladders).

I. "EXPOSED" means installed outside of the building finish such that it is visible to the eye.

PART 8 - SUBMITTALS

A. Submit, as part of the bid, manufacturer's product data sheets for all material and equipment whose products are proposed. Only specified or accepted manufacturers or suppliers shall appear in the Product Data Submittal. The Contractor's Bid shall not be considered without a complete Product Data Submittal. Any requests for approval of substitutions for products not listed in this specification must be made prior to bid submittal.

B. Mark each data (cut) sheet to show applicable choices and options. Where product data includes information on several products, some of which are not required, mark copies to indicate the applicable information.

C. The Contractor shall submit sample reports showing the proposed format for cable test reports.

D. Acceptance of any submitted data for material, equipment, apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to perform efficiently the requirements and intent of the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data.

E. Project Documentation:
   1. Provide drawings annotated with the changes made during the installation of the work performed.
   2. Provide the Architect with two (2) sets of all manufacturer's literature and data sheets in a high quality, 3-ring binder, completely indexed not more than 1 week after project completion.
   3. Upon completion of work and acceptance by OEM, provide annotated drawings showing the exact location and type of each cable termination point.

PART 9 - QUALITY ASSURANCE

A. Contractor is solely responsible for quality control of the Work.

B. All materials furnished shall be new, unused, clean, undamaged, free of corrosion and free from mechanical or electrical defects.

C. All materials shall meet all applicable codes provided a standard has been established for the material in question.

D. The installation shall comply fully with all government authorities, laws and ordinances, regulations and codes applicable to the installation.

E. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Architect at the time of submitting the construction schedule.

F. No splices shall be allowed between cable termination points.

G. The Contractor must carefully check space requirements and the physical confines of the area of work to insure that all material can be installed in the designated spaces including raceways and cable supports.

H. Transmit to other Contractors all information required for work to be provided under their respective Sections in ample time for installation.

I. *Wherever work interconnects with, or contacts, the work of other trades, the Contract shall coordinate his work with other Contractors to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.*

J. *Due to the fast-track nature of this project, strong coordination with all Contractors is required to properly install the cabling system.*

Notes:

1. The Contractor is specifically directed to check all field conditions before starting work to ensure that field conditions have not changed.

PART 10 - DELIVERY, STORAGE AND HANDLING

A. All materials (except bulk materials) are to be delivered in manufacturer's unopened containers, fully identified with manufacturer's name, trade name, type, class, grade, size and color as appropriate.

B. Materials shall be suitably sheltered from the damage and theft, but readily accessible for inspection by the Architect until installed. Store all items subject to moisture damage in dry, clean spaces.

C. The Construction Manager will try to accommodate Contractor's reasonable request for on-site storage space. Storage space will be assigned by the Construction Manager on a space available basis and is not guaranteed. Contractor must submit a request for on-site storage space with his bid response.

PART 11 - WARRANTY/EXTENDED WARRANTY PROGRAM

A. The Contractor shall provide, in writing, a minimum of a one-year (1-year) *no-cost* warranty policy against materials and workmanship supplied under this contract.

B. The Contractor may propose extended warranty as an add alternate.

PART 12 - PRODUCTS

A. Where particular items are explicitly identified in the specification or indicated on the drawings for a specific application, the Contractor is to use only those products or materials.

B. Only substitutes approved in writing, before installation, by the Architect or the Architect's designated representative may be used as alternative products.

C. Part numbers provided in this section are believed to be correct. However, if the listed part number has been changed, discontinued or superseded, the Contractor is responsible for bringing this to the Architect's attention so that approval may be obtained for currently available products. Should a particular part number prove to be invalid, the Contractor shall provide the Architect with product data sheets and specifications for the suggested alternate.

D. Section 12, PART NUMBERS, contains a list of cables and equipment used in this project. It is the Contractor's responsibility to ensure that only the items actually specified in this Scope of Work are installed.

E. The specific manufacturers' products and part numbers listed below shall be furnished and installed under this contract. In addition, "Or Approved Equal" substitutes may be used with the written approval of the Architect or his designated representative.

F. It is the intention of this specification to establish a benchmark of quality both in the products selected, and in the performance and warranty afforded to the user upon successful completion of the cabling installation. When the Contractor exercises an option to substitute a particular component or group of components under this contract, he must provide documentation and sample product which identifies the performance and quality of the specified product.

G. Subject to compliance with the technical requirements of this section and the bid requirements provided in general Conditions, the Contractor shall provide cable and equipment from the following manufacturers.

PART 13 - PART NUMBERS

Fiber Optic Cables

A. **Twenty-four-strand (24-strand) multi-mode plenum fiber optic cable.**
Primary use: intra-building interconnection of voice or data equipment.
Supplier: Berk-Tek or approved equal
Part Number PDP6B024-CB3510/15
Description: Multi-mode fiber optic cable; 62.5 micron core, 125 micron cladding, 250 micron coating, and 900 micron buffering; minimum bend radius during installation of no less than twenty (20) times the outside cable diameter; minimum bend radius after installation of no less than ten (10) times the outside cable diameter; maximum attenuation at 850 nanometers (nm) of 3.5 dB per kilometer (km); maximum attenuation at 1,300 nm of 1.0 dB per km; minimum bandwidth of 200 MHz. at 850 nm; minimum bandwidth of 500 MHz. at 1,300 nm; numerical aperture of 0.275; reinforced with Aramid yard; no metallic elements.

Quantity to be supplied: As determined by bidder's calculations

B. ***Six-strand (6-strand) single-mode plenum fiber optic cable.***
Primary use: intra-building interconnection of voice or data equipment.
Supplier: Berk-Tek or approved equal
Part Number PDP012-AB1010
Description: Single-mode fiber optic cable; 8.3 micron core, 125 micron cladding, 250 micron coating, and 900 micron buffering; minimum bend radius during installation of no less than twenty (20) times the outside cable diameter; minimum bend radius after installation of no less than ten (10) times the outside cable diameter; maximum attenuation at 1310 nanometers (nm) of 1.0 dB per kilometer (km); maximum attenuation at 1,550 nm of 1.0 dB per km; reinforced with Aramid yard; no metallic elements.

Quantity to be supplied: As determined by bidder's calculations

Fiber Optic Termination Cabinets

Primary use: to provide termination of fiber optic cables in telecommunication racks.
Supplier: Ortronics or approved equal
Part Number: OR-625MMC-24PG1B (24-port)
OR-625MMC-48PG1B (48-port)
Description: Fiber optic interconnection unit capable of terminating up to 48 simplex multi-mode fiber optic cables per cabinet; SC connectors with zirconia ferrule.

Quantity to be supplied:

Fiber Optic Patch Cords and Connectors

A. **Multi-Mode Fiber Optic Patch Cords**
Primary Use: Interconnection of equipment.
Supplier: Ortronics or approved equal
Part Number: OR-61150J62010F99C
Description: Multi-mode, ten-foot (10'), simplex, fiber optic patch cord with zirconia ferrules and SC connectors.

Quantity to be supplied: Fifty (50) pieces.

B. ***Single-Mode Fiber Optic Patch Cords***
Supplier: Ortronics or approved equal
Part Number: OR-61150J08010F99C
Description: Single-mode, ten-foot (10'), simplex, fiber optic patch cord with zirconia ferrules and SC connectors.

Quantity to be supplied: Twelve (12) pieces.

C. **Fiber Optic Cable Connectors**
Primary Use: to terminate fiber optic cables.
Supplier: *Amphenol or approved equal*
Part Number: 954-101-5006, single-mode
954-101-5010, multi-mode
Description: Type SC fiber optic cable connectors; typical insertion loss <0.19 dB for single-mode and <0.15 dB for multi-mode fiber.

Quantity to be supplied: As required to terminate backbone cables.

Wire Management

A. **Backboard Wire Management Hardware, D-Rings**
Primary Use: to allow the installation of cables in a neat and workman-like manner.
Typical Supplier: Siemon Company
Part Number: S145, 4" Horizontal
Part Number: S146, 6" Vertical
Description: Distribution-rings; lightweight; self extinguishing; molded polycarbonate; split front.

Quantity to be supplied: as required for neat and orderly cable management.

B. **Suspended Cable Wire Management Hardware, Type 1**
Primary Use: primary method of supporting cables in ceiling areas not equipped with cable tray.
Typical Supplier: Erico (Caddy Fasteners)
Part Number: CAT425 (see data sheet for specific catalog numbers for flange, beam and purlin mounting options).
Description: Adjustable cable support loop designed to enclose up to 425 Cat. 5, UTP cables. Design prevents stress points when distributing large numbers of cables. *Installation Note:* Support loops must be mounted securely to building structural components such as the floor slab above, structural steel, or concrete beams. Do not mount support loops to ceiling panel supports, ductwork, piping, electrical conduit, trunking, or other non-structural members.

Quantity to be supplied: as required for neat and orderly cable management.

C. **Suspended Cable Wire Management Hardware, Type 2**
Primary Use: to provide support for cables in horizontal, overhead cable paths where cable tray is not available.
Typical Supplier: Erico Fastening Products
Part Number: WMX6
Description: Metallic J-hook bracket. *Installation Note:* J-hooks must be mounted securely to building structural components such as the floor slab above, structural steel, or concrete beams. Do not mount J-hooks to ceiling panel supports, ductwork, piping, electrical conduit, or other non-structural members. *Do not support more than six (6) cables from a single J-Hook.*

Quantity to be supplied: as required for neat and orderly cable management.

D. **Cable Management Straps**

Primary Use: organize and manage telecommunications cables.

Typical Supplier: Ortronics or approved equal

Part Number: OR-70700080-XX (6")
OR-70700079-XX (12")
(replace XX with desired color code)

Description: Cable straps with hook-and-loop fasteners, 0.625" wide, available in 6 colors. *Installation Note:* To prevent damage, plastic cable ties shall not be used to bundle, organize or manage UTP or fiber optic cables.

Quantity to be supplied: as required for neat and orderly cable management.

Labels

Primary Use: provide permanent marking and identification of cables and components.
Typical Supplier: Panduit Corporation
Part Number: Contractor's option to meet specifications.
Description: Pre-printed, or machine printed on-site, self-adhesive, smudge-resistant labels. *Installation Note:* Labels shall be sized appropriately for the item to which it will be applied and the amount of information to be displayed. If machine-printed labels are used, no characters smaller than 10-point shall be used. For maximum legibility sans serif typefaces are preferred. When labels are applied to round objects such as cables, special attention shall be paid to ensure that the label will not unwrap itself due to stress relief. The Contractor shall apply labels as detailed on drawings and as identified on cable pull schedules to each cable, patch panel, termination block and faceplate as required. Labels shall be appropriately colored for maximum contrast.

Provide machine generated designation strips marked with the cable ID and pair number, in black uppercase lettering, on all termination blocks installed under this contract.

Attach machine-generated labels to all telecommunications cables installed under this contract. The labels shall contain the cable ID printed in black uppercase lettering on white label stock. The printed portion of the label shall be protected by a permanent, water-resistant, transparent top layer. The label shall fastened with a permanent adhesive.

Labels shall be placed on both ends of the cable not more than 6 inches from the end of the outer sheath. All labels shall be readily visible after installation of the cable.

Hand-lettered labels will not be accepted upon completion of the work required under this contract. Hand-lettered labels may only be used for temporary labeling required during installation.

If at any time during the project, a label becomes illegible, damaged or is removed, the Contractor shall immediately replace it with a satisfactory new label.

Fire Stopping Materials

Primary Use: materials installed to prevent the spread of fire vertically or horizontally via cable openings and penetrations.
Typical Supplier: As specified in the electrical drawings.
Part Number: As required to meet specifications.
Description: Fire barrier materials installed after cable installation has been completed to maintain the fire rating of partitions, walls or slabs penetrated by telecommunications cabling. All fire stopping shall be made of intumescent materials which expand at temperatures normally encountered during free-burning combustion to provide an effective seal against flame spread, smoke, and toxic fumes. Intumescent sheets may be used to fire stop open riser slots. The sheets shall be effectively installed to seal the penetrations against flame spread, smoke and toxic fumes. Composite sheets shall be attached to floor slabs using intumescent materials. The fire rating of the material used for fire stopping shall be at least equal to that of the floor or wall into which it is installed so that the original fire rating of the floor or wall is maintained

No flammable material may be used to line the chase or hole in which fire stopping material is to be installed. When damming materials are to be left in place after the seal is complete, then all such materials shall be non-flammable.

Fire stopping sealant shall remain resilient and pliable to allow the future removal or addition of cables without the necessity of drilling holes. The sealant shall adhere to itself perfectly to allow any and all repairs to be made with the same material. It shall accommodate continuous mechanical vibration and repeated environmental thermal expansion cycles without affecting the quality of the seal from cracking, crumbling or spalling.

If sealant is injected into a penetration, the material shall expand to surround all the items within the penetration and maintain pressure against the walls of the penetration as well as the pass-through items. The material shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the material to prevent the passage of fire, smoke or water.

The fire stopping materials shall have been tested to fire exposure in accordance with the standard time-temperature curve given in ASTM standard 119 and NFPA standard 251. The fire stop material shall have also been subjected to the hose stream test in accordance with UL standard 10B.

PART 14 - EXECUTION

A. Verification of Field Conditions: The Contractor shall examine the areas to receive the work and the conditions under which the work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the contract. The Contractor shall not proceed until unsatisfactory conditions have been corrected.

B. The Contractor shall examine and compare the Telecommunications Drawings and Specifications with the Drawings and Specifications of other trades. The Contractor shall report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the work. At time of bid, the most stringent requirements shall be included in the bid.

C. The Contractor shall install and coordinate the cabling work described in this document with the cooperation of the other contractors working on this project. Before installation the Contractor will make provisions to avoid interferences with other contractors in a manner acceptable to the Architect.

D. All repairs or changes required as a result of damage or neglect caused by the Contractor shall be correct by the Contractor to the satisfaction of the Architect at the Contractor's own expense.

E. The Contractor shall maintain a current copy of this bid specification and associated telecommunications drawings at the job site at all times.

F. The Contractor shall follow all manufacturer instructions for unpacking, installing, testing, and commissioning of cables and equipment. The Contractor shall submit two (2) copies of each instructions to the Architect before installing any cabling or equipment. If specific instructions are not available, industry standard practices and workmanlike installation standards shall be followed.

G. All cables shall be tested after termination to confirm that they meet or exceed the specifications given in this document. Test results shall be submitted to the Architect in the form of numerical values where appropriate with an optional Pass/Fail summary designation.

H. Telecommunications cables running parallel to electrical power cables or conduits shall be separated by a minimum of 12 inches whenever possible.

I. The Contractor shall ensure that all telecommunications cable supports are fully installed before proceeding with cable installation. At no times shall cables be installed and left

unsupported. At no times shall cables be tie-wrapped to any other supporting structure in lieu of specified cable supports. Do not bundle or tie-wrap the cables even within the approved cable supports.

J. Do not lay telecommunications cables unprotected on the floor at any time. If cables must be left on the floor where they are likely to be damaged from foot traffic or mechanical devices, the cables shall be protected from damage by substantial covers or platforms.

K. The cable manufacturer's recommended minimum bend radius must be maintained at all times. Do not exceed the maximum allowable pulling tension when installing the cable. Do not tightly coil, sharply bend or tightly crimp cables. If the Architect believes that cables have been subjected to potential damage during installation, the Architect shall document such damage and require the Contractor to replace the designated cables.

L. Keep all items protected before and after installation from dust, dirt and moisture. It shall be the contractor's responsibility to ensure the integrity of these protective measures throughout the life of the project.

M. At all times during the work required under this contract the Contractor shall protect all telecommunications equipment from damage including vandalism. Equipment in the telecommunications closets shall not be installed until such time as other trades have completed their work in that area so that the equipment will not be moved or damaged.

N. The Contractor shall maintain all areas related to his work in a clean and orderly manner. Debris generated by the Contractor shall be disposed of properly at the end of each shift.

O. Upon project completion, the Contractor shall provide as-built drawings and documentation as defined herein.

P. There shall be no splices or mechanical couplers installed between the cable points of origin and termination.

Q. Installation personnel shall be qualified to perform the work required. The Architect reserves the right to have the Contractor remove or replace any of the Contractor's personnel at its sole discretion. Whenever possible technicians certified by the manufacturer of the equipment shall perform the work required under this contract. The technicians shall be knowledgeable of the following:

1. Cable color coding
2. Bonding and grounding technology
3. Cable testing techniques and test equipment

4. Cable termination, connectors, and splicing
5. Generally accepted industry standards and practices

PART 15 - FIELD QUALITY CONTROL

A. After the installation is complete the Contractor shall perform testing to demonstrate that the installation meets the specifications in this document. The Contractor shall notify the Architect at least two (2) business days in advance of the start of testing so that the Architect or his designated representative may be present during the testing if the Architect so desires. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.

End of Specification

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COPPER BACKBONE CABLING REQUIREMENTS

From	To	Qty.	Type	Use
LAN Room	Aux. LAN room	2	25-pair Cat. 5, UTP binder cable	Spare
LAN Room	Mayor's Suite AV room	1	25-pair Cat. 5, UTP binder cable	ISDN, etc.
LAN Room	Mayor's Suite security room	4	25-pair Cat. 5, UTP binder cable	LAN
LAN Room	Motorola Equipment room	1	100-pair Cat. 3, UTP riser cable	Motorola
LAN Room	Public Information Unit	1	100-pair Cat. 3, UTP riser cable	Aux phone
LAN Room	Emergency Operations Ctr.	1	100-pair Cat. 3, UTP riser cable	Aux phone
LAN Room	Mayor's Suite security room	1	200-pair Cat. 3, UTP riser cable	WinStar service
LAN Room	Mayor's Suite security room	1	200-pair Cat. 3, UTP riser cable	TCG service

FIBER OPTIC BACKBONE CABLING REQUIREMENTS

From	To	Qty.	Type	Use
LAN Room	Aux. LAN room	1	24-strand multimode fiber optic cable	LAN Backbone
Press Room	PA Loading Dock Area	1	24-strand multimode fiber optic cable	Press corp video feed
LAN Room	Aux. LAN room	1	6-strand single-mode fiber optic cable	LAN Backbone

SMW Project 5149

NEW YORK CITY OFFICE OF EMERGENCY MANAGEMENT
EMERGENCY OPERATIONS CENTER

Section 16700C
Data, Cable TV and Miscellaneous Systems Infrastructure Specifications

Prepared for:
Swanke Hayden Connell Architects
New York, New York

April 6, 1998

TABLE OF CONTENTS

PART 1 - INTRODUCTION AND PROJECT BRIEF 3
Section 16700 Documents 3
Section 16700A 3
Section 16700B 3
Section 16700C 3
Office of Emergency Management Department of Information Technology
Scope of Work Summary
..... 3
Notes 4

PART 2 - GENERAL TERMS AND CONDITIONS 5

PART 3 - SPECIAL CONDITIONS 6

PART 4 - WORK NOT INCLUDED 6

PART 5 - REFERENCE DRAWINGS 6

PART 6 - DEFINITIONS 7

PART 7 - QUALITY ASSURANCE 8

PART 8 - EXECUTION 8

PART 9 - FIELD QUALITY CONTROL 9

SECTION 16700C
DATA, CABLE TV AND MISCELLANEOUS SYSTEMS
INFRASTRUCTURE SPECIFICATIONS

PART 1 - INTRODUCTION AND PROJECT BRIEF

The New York City Office of Emergency Management (OEM) which operates under the authority of the Office of the Mayor of the City of New York is in the process of creating an Emergency Operations Center (EOC) at 7 World Trade Center. The architectural firm of Swanke Hayden Connell of New York City has engaged the consulting firm of Shen Milsom and Wilke of New York City as a specialty consultant in the area of technology infrastructure design. This infrastructure will utilize a mixture of copper and fiber optic cables to transport voice, data, video and multimedia services throughout the facility.

Section 16700 Documents

1. Section 16700A describes the New York City Department of Information Technology and Telecommunications (DoITT) Scope of Work.

2. Section 16700B describes the installation of the facility's copper and fiber optic backbone cabling for services not covered in Section 16700A.

3. Section 16700C (this document) describes the installation of the facility's data, cable TV services and other miscellaneous systems infrastructure not described elsewhere.

Office of Emergency Management Department of Information Technology Scope of Work Summary

(1) obtaining and provisioning of all telecommunications services other than those described in Section 16700A (i.e. services not provided by Bell Atlantic, WinStar and Teleport Communications Group) as required to support the requirements of the EOC;

(2) the oversight, coordination and supervision of the installation of the required telecommunications services including proprietary cabling and equipment racks if not provided in Sections 16700A or 16700B;

(3) the testing and final acceptance of the required telecommunications services;

(4) obtaining and provisioning cable television services from service providers (e.g. Time-Warner) as required to support the requirements of the EOC;

(5) the oversight, coordination and supervision of the installation of the required cable television services including cabling and equipment racks if not provided in Sections 16700A or 16700B;

(6) the testing and final acceptance of the required cable television services;

(7) the installation, setup, testing and commissioning of all Local Area and Wide Area Networking (LAN/WAN) hardware and software;

(8) the installation, setup, testing and commissioning of all OEM personal computers and related accessories; and

(9) the procurement and installation, if required, of BALUNS to allow FD, PD and EMS computer terminals to utilize UTP cabling instead of RG-62 coaxial cable.

Notes:

1. *The term "installation" includes the materials and labor required to physically install, test and make fully functional the OEM LAN/WAN network. After installation the system shall be fully functional and ready to use for its intended purpose.*

PART 2 - GENERAL TERMS AND CONDITIONS

The following shall apply to all work under Section 16700C:

A. All work shall comply with applicable federal, state and local regulations and statues.

B. *The specifications in this document explain the basic scope of work to be performed and the basic duties of the installer. This document is not intended to be used as a complete Design Manual or Bill of Materials for all materials required under this Section.*

C. The work to be performed under this Section may require that existing telecommunications services be interrupted for equipment installation or testing. Therefore, the installer must work in close cooperation with the project team to coordinate and schedule the work to be done. The installer should expect that some of the work required under this contract will be done after normal business hours, on holidays and on weekends depending on the project schedule or to minimize service disruptions.

D. Every attempt will be made to provide complete written documentation for the work to be done under this contract, but the installer must be prepared to work from verbal directions from designated project personnel. Such verbal communication shall be documented, in writing, without delay and circulated to all parties.

E. It is the installer's responsibility to coordinate and provide for the movement of equipment, delivery of materials, access to the job site, establishing a site office and other ancillary activities.

PART 3 - SPECIAL CONDITIONS

A.. The installer is responsible for, and shall pay for, any and all permits and licenses required under this contract. The installer shall request, obtain, and schedule any and all required inspections or other regulatory coordination services as may be required. If required, the installer shall coordinate his activities with service providers to obtain the services required under this contract.

B. *Any items not specifically shown on the drawings or called for in the specifications, but normally required to conform with the intent of this Section are to be considered as part of the Scope of Work.*

C. *Should terminology, including, but not limited to, "shall"; "provide"; "install;" "complete;" "furnish" fail to be included explicitly in the text of this document, they shall apply implicitly to ensure that a fully-functional cabling system is provided.*

D. *The Scope of Work covered by this Section includes the items described in Section 1 of this document including all labor necessary to perform and complete such construction, all materials and equipment required and all services, facilities, tools, equipment necessary to perform and complete such installation.*

PART 4 - WORK NOT INCLUDED

A. Cable tray installation.
B. Conduit sleeves.
C. Commercial AC power wiring and outlets.
D. Telecommunications grounding system.

PART 5 - REFERENCE DRAWINGS

TC-100	General Notes and Symbols
TC-101	Telecommunications Backbone Pathways Schematic
TC-102	Telecommunications Backbone Cabling Schematic
TC-103	Telecommunications Work Outlet Locations

The Contractor is specifically directed to review, and become familiar with, the Architectural ("A") and Electrical ("E") drawings to understand the full details of the project.

PART 6 - DEFINITIONS

A. "PROVIDE" or "FURNISH" means to supply, purchase, transport, place, erect, connect, test and turn over to the user, complete and ready for normal commercial operation, the cabling systems referred to in this document.

B. "SUPPLY" means to purchase, procure, acquire, and deliver the required goods and services to the locations as designed.

C. "INSTALL" means to move from property line, set in place, join, unite, fasten, link, attach, set up or otherwise connect together equipment supplied under this contract. Installation shall be considered complete when the equipment or system is ready for normal commercial operation.

D. "WIRE, WIRING" means the inclusion of all cables, fittings, conductors, connectors, connector strips, connections, terminations and cable management devices, etc. required in connection with this work.

E. "AS DIRECTED" means as directed by the Architect or his representative.

F. "CONCEALED" means embedded in masonry or other construction methods such that physical damage must to done to access the cabling or device once construction is completed.

G. "ACCESSIBLE" means an item embedded in the building construction, but for which an access method has been provided.

H. "READILY ACCESSIBLE" mean an item that may be accessed or operated without the use of special tools or equipment (e.g. ladders).

I. "EXPOSED" means installed outside of the building finish such that it is visible to the eye.

PART 7 - QUALITY ASSURANCE

A. The installer must carefully check space requirements and the physical confines of the area of work to insure that all material can be installed in the designated spaces including raceways and cable supports.

B. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.

C. *Wherever work interconnects with, or contacts, the work of other trades, the installer shall coordinate his work with others to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.*

D. *Due to the fast-track nature of this project, strong coordination is required to ensure deadlines will be met.*

Notes:

1. The installer is specifically directed to check all field conditions before starting work to ensure that field conditions have not changed.

PART 8 - EXECUTION

A. Verification of Field Conditions: The installer shall examine the areas to receive the work and the conditions under which the work would be performed. The installer shall remedy conditions detrimental to the proper and timely completion of the contract. The installation shall not proceed until unsatisfactory conditions have been corrected.

B. The installer shall examine and compare the Telecommunications Drawings and Specifications with the Drawings and Specifications of other trades. The installer shall report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the work. At case of conflict, the most stringent requirements shall be used.

C. Provisions to avoid interferences with other trades and contractors are required.

D. All repairs or changes required as a result of damage or neglect caused by the installer shall be corrected by the installer to the satisfaction of the Architect at the installer's own expense.

E. The installer shall follow all manufacturer instructions for unpacking, installing, testing, and commissioning of equipment. The installer shall submit two (2) copies of each instructions to the Architect before installing any equipment. If specific instructions are

not available, industry standard practices and workmanlike installation standards shall be followed.

F. At all times during the work required under this contract the installer shall protect all telecommunications equipment from damage including vandalism. Equipment in the telecommunications closets shall not be installed until such time as other trades have completed their work in that area so that the equipment will not be moved or damaged.

PART 9 - FIELD QUALITY CONTROL

A. After the installation is complete the Contractor shall perform testing to demonstrate that the installation meets the specifications in this document. The Contractor shall notify the Architect at least two (2) business days in advance of the start of testing so that the Architect or his designated representative may be present during the testing if the Architect so desires. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.

End of Specification

SMW Project 5149

NEW YORK CITY OFFICE OF EMERGENCY MANAGEMENT
EMERGENCY OPERATIONS CENTER

Section 16700
Cable Tray Specification

Prepared for:
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New York, New York

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TABLE OF CONTENTS

SECTION 1 - MANUFACTURER ..... Page 3 of 4

SECTION 2 - CABLE TRAY SECTIONS AND COMPONENTS ..... Page 3 of 4

SECTION 3 - LOADING CAPACITIES AND TESTING ..... Page 4 of 4

SECTION 4 - GROUNDING ..... Page 4 of 4

SECTION 5 - PART NUMBERS ..... Page 4 of 4

SECTION 6 - SPECIAL CONDITIONS ..... Page 4 of 4

SECTION 1 - MANUFACTURER

1.0 B-Line Systems DATA-TRACK or approved equal
Center spine bottom rung aluminum ladder type cable tray. Cable tray sides are open for easy loading and inspection of cables. See manufacturer's catalog for connectors, T's and ancillary hardware required to provide a complete installation.

SECTION 2 - CABLE TRAY SECTIONS AND COMPONENTS

2.0 Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated with splice hangers and all other necessary accessories. Provide cable trays with rounded edges and smooth surfaces in compliance with applicable standards, and with the following additional constrcution features.

2.1 Aluminum center rails and rungs shall be extruded from type 6063 aluminum. All fabricated parts shall be made from type 5052 aluminum and all cast parts shall be made from type 319 aluminum. All hardware and fasteners shall be zinc plated steel in compliance with ASTM B633.

2.2 Cable trays shall be constructed of a center rail 1.625" X 3.250" with minimum section properties of Sx = 0.701 in^3 and Ix = 1.174 in^4. Rungs shall be a single continuous square tube 0.54" X 0.54" with radiused corners and minimum section properties of Sx = 0.019 in^3 and Ix = 0.005 in^4. Rungs shall be mechanically connected to the center rail in at least two places, symmetrical about the center rail, with ends finished to protect installers and cables.

2.3 Rungs shall be spaced every twelve (12') inches.

2.4 Straight sections shall be supplied in ten (10') foot lengths.

2.5 Splice hangers must also be capable of acting as the support points for all-thread rod.

2.6 Cable tray loading depth shall be four (4") inches.

2.7 Cable tray width shall be twelve (12") or eighteen (18") inches as indicated on the telecommunications drawings.

2.8 All splices and connectors must protect cables from the edges of the center rail and act as a barrier to prevent the center rail from transmitting hazardous gases or smoke; hardware must be installed vertically so as not to interfere with the cables in the cable fill area.

2.9 Where required, expansion splices shall allow for 1" of thermal expansion and contraction.

2.10 When required, and to provide an area free of center rails for cable transitions, contractor shall install a universal hub fitting. The universal hub fitting must be a cast aluminum structural member, B-line CAU Series (flat sheets of steel or aluminum are not acceptable), which can be used with cable ties and allows the center rails to be connected so they may be pivoted at connection points.

SECTION 3 - LOADING CAPACITIES AND TESTING

3.0 Cable tray shall meet the loading requirements of NEMA 12C

3.1 Upon request, manufacturer shall provide test reports in accordance with the latest revision of NEMA VE-1 or CSA C22.2 No. 126-M91.

SECTION 4 - GROUNDING

4.0 Cable tray shall be grounded with a grounding jumper to a building approved ground location. Grounding shall meet the requirements set by ANSI/TIA/EIA 606

SECTION 5 - PART NUMBERS

The following part numbers are typical of the cable tray components that will be used on this project. It does not constitute a complete Bill of Materials.

C4-A-DB-06-18-120 (18-inch cable tray)
C4-A-DB-06-12-120 (12-inch cable tray)
CAM-DO-10 (cable drop-outs)
CAS-SB ("Qwik"-Bolt Splice Hanger)

SECTION 6 - SPECIAL CONDITIONS

6.0 In the Emergency Operations Center hollow triangular wall sections will be used to transition cables from the overhead ceiling area to the area underneath a four-inch (4") nominal raised floor. In these areas eighteen-inch (18") B-Line Series 4 ladder type aluminum cable tray (typical part number 25-A-12-18-120) shall be fastened vertically at the approximate center of the rear of the triangle to support the cables as they transition from the overhead to the underfloor area. The vertical cable tray shall be mounted on stand-offs approximately four-inches (4") from the supporting wall.